Solving the Program Evaluation Puzzle

CTE Program Evaluations

Federal and State Laws mandate the creation and use of CTE Program Evaluations. The Carl D. Perkins Law Section 122(c)(5) states that a school must create a plan that "describes how the eligible agency will actively involve parents, academic and career and technical education teachers, administrators, faculty, career guidance and academic counselors, local business (including small businesses), and labor organizations in the planning, development, implementation, and evaluation of such career and technical education programs" The Texas State Plan for Career and Technical Education additionally states that "Texas requires that eligible recipients annually evaluate their CTE program. Texas school districts have local advisory committees for CTE that are involved in decisions related to the implementation, improvement and evaluation of CTE programs."

Additionally, a thorough program evaluation each year gives you great data about the successes of your CTE program, the needs of your CTE program, and goals and objectives for upcoming years.

Consider making your Program Evaluation each year a portfolio of the academic year. A well-organized notebook presented to school administrators, advisory committee members, and school board members will ensure that the appropriate people are aware of the operation of your CTE department.

An example yearly portfolio could include the following information collected during that school year[1]:

- An introductory letter from the CTE director
- The CTE department mission statement
- Enhancements that were made to the CTE program
- Accomplishments and Recognitions of CTE students and teachers
- Professional Development records of CTE teachers and administrators
- PEIMS coding summary
- CTE State Weighted Funding Allotment and expenditures
- College and Career Readiness progress made
- Student Certifications earned
- Dual CTE credit earned
- TAKS/EOC results for CTE students
- Advisory Council membership and meeting minutes
- Student Attendance Accounting Handbook Guidelines for CTE
- CTE Program Recruitment Activities
- Professional Learning Communities within the CTE Department
- Federal CTE Requirements
- Picture gallery of student/teacher work

[1] Courtesy of Hallsville High School CTE Director, Kathy Gaw


Teachers

Program Evaluation Question Stems

Teachers:

- Curriculum/TEKS/Instruction
  - At what level do teachers understand and cover all CTE course TEKS?
  - Does the teacher have documentation that all TEKS are covered during the year/semester? If so, where is the documentation?
  - Have all CTE teachers have been trained on using instructional strategies?
  - How often do CTE teachers reinforce priority academic TEKS in the classroom?
  - At what level is the CTE curriculum current, relevant to career development, and rigorously taught?
  - How is CTE curriculum enriched with related resources (audiovisuals, guest speakers, field trips, other community resources, internet, CD-ROM, etc...)?
  - Do CTE teachers submit lesson plans? If so, do they have a focus on student engagement, instructional activities, and a variety of assessment types?
  - What has been done to ensure that CTE teachers understand the current Texas assessment for student progress?
  - Do CTE teachers receive training on methods for using disaggregated assessment data?
  - Does instruction provide adequate opportunity for each student to develop the necessary skills and competencies for employment?
  - Is an annual plan of instruction maintained by the teacher with specified goals and objectives? (Scope & Sequence)
  - Is a well-defined grading system in use, and was a copy given to each student?
  - Are CTE teachers periodically evaluated by administrators? What type(s) of evaluations are conducted?
  - What are typical enrollment and class sizes for CTE classrooms? Compared to core areas?
  - How often do teachers help to educate counselors and administrators about the goals, objectives, activities, prerequisites, enrollment guidelines, etc., of their classes?
  - Is technology is incorporated into program instruction? Is this documented?
  - Do teachers use rubrics to score performance based tasks or assessments?
  - Have teachers submit a copy of a lesson plan that showcases academic/CTE integration.
  - Have teachers submit a copy of conference/professional development attendance records, including training to address the needs of special populations.
  - Have teachers submit a copy of new teacher certifications and endorsements.
  - Have teachers submit a copy of the syllabi for the courses taught this year.
- Coherent Sequences
  - At what level do teachers comprehend the sequence and design of local career clusters, including articulation and certification opportunities?
  - Do CTE instructors and counselors annually assist students in the updating of 4 year plans referenced in campus and district planning documents?
- Certification
  - Do all of your CTE teachers hold a valid certification appropriate for the classes they teach?
  - When necessary, are teachers documented as HQ for CASA?
  - Are teachers certified to participate in the ATC program?
- Industry Standards
  - Do CTE teachers promote industry certification programs through their courses?
  - How thoroughly have industry standards and needs have been addressed in the curriculum?
  - How do teachers involve business and industry in your program? Examples?
- Special Populations/Program Access/CTSO
  - How frequently are teachers provided training opportunities to ensure the needs of special populations are met?
  - How have teachers implemented strategies learned in those sessions into the classroom?

Program Evaluation Question Stems

- How thoroughly do CTE teachers understand and comply with legislation and statutory requirements for Program Access Review?
- Does every student (including special pops) have the opportunity to become an active member of a CTSO?
- Does the instructional program encourage the elimination of bias and stereotyping?
- Do teachers have access to individual student files containing the assessment of students' interests, abilities, and special needs, and is the information used appropriately to direct effective student learning?
- Do teachers have an effective procedure to market their programs and recruit new students?
- Are efforts made to recruit nontraditional students?
- Are time and resources provided to support activities of the CTSO chapter advisor?
- Are CTSO activities an integral part of the instructional program in the attainment and balance of the primary program objectives?
- Is the local CTSO in good standing with the state and national organizations?
- Does the CTSO chapter hold an annual banquet for awards and recognition of students with parents, school officials, and community leaders invited?
- Have teachers submit a copy of flyers or recruitment materials used for classes/CTSO's.
- Have teachers submit a copy of the CTSO Roster for the year.

- Budgeting
  - What is the process in your district to make CTE staff aware of federal, state, and discretionary grant funds and understand the process for using allocations appropriately?
  - What is the process for determining and spending the CTE funds available?
  - Is there evidence that teachers understand the school budget process and effectively use those procedures to purchase supplies and materials?
- Professional Development
  - To what extent does teacher professional development plans focus on best practices, integrating standards into course curricula, and remaining current with business/industry innovations?
  - Do all teachers have an up to date professional development plan?
  - How often are core academic teachers involved in technology based staff development that emphasizes CTE skill sets students need?
  - Do all CTE teachers maintain membership in related professional organizations and attend all appropriate activities?
  - Have teachers attended state-wide professional development conferences for related program areas? If so, when?
  - Have teachers attended other professional development activities? If so, when/what topics?


STUDENTS

Program Evaluation Question Stems

Students:

- Do CTE clusters provide industry certification opportunities for all students?
- Is CTE student performance data is regularly used to assess program effectiveness?
- How gender equity is reflected in student enrollment?
- How do students have the opportunity to develop a career goal by accessing career information and receiving adult guidance for courses and programs?
- Is each student afforded the opportunity to become an active member of a CTSO?
- Are CTSO activities an integral part of the instructional program?
- Was each CTSO member provided the opportunity to attend and participate in local, state, and/or national level activities?
- What type of career assessment or interest inventory do you administer to your students?
- What type and method of feedback do you provide to students regarding the career assessment?
- In what ways do you share this information with parents?
- Do you conduct end of course evaluations done by the students?
- Was each student afforded the opportunity to participate in a community service project?
- Do students have the opportunity to participate in a career preparation program (when at least 16 years of age)?


Advisory Committees

Program Evaluation Question Stems

Advisory Committees:

- To what extent does advisory committee membership reflects the diversity of the CTE program?
- Can you show that Advisory Committee agenda and minutes are kept on file?
- How does the Advisory Committee review CTE goals, facilities, programs and performance targets annually?
- Does the advisory committee include representation from school administration, counselors, parents, academic faculty, and appropriate industry persons?
- Are the recommendations from the advisory committee acted upon and/or incorporated into the curriculum and the results relayed to all committee members?
- Is your district recruiting members for the district/campus advisory committee?
- How are CTE programs building community, business, and/or industry partnerships?
- Do school administrators actively participate in the CTE advisory committee?


FACILITIES

Program Evaluation Question Stems

Facilities:

- Have the facilities been properly maintained to provide an environment conducive to learning and working?
- Are the facilities arranged in such a manner as to maximize instructional function, supervision, class control, and student safety and simulate an industry environment as appropriate?
- Is storage space functional and adequate for instructional materials, supplies, equipment, and projects of the program?
- Is adequate office space provided that contains a computer, printer, telephone, desk, and other necessary equipment?
- Can the present facility be changed/adapted to accommodate a change in the direction of curriculum or to accommodate other modifications in equipment, safety, etc?
- Is an appropriate storage area or locked cabinet provided for storing hazardous materials where appropriate?
- Is safety instruction planned, presented, demonstrated, and practiced by the teacher in instructional and laboratory activities?
- Does the instructional facility provide adequate heat, light, ventilation, dust control, and noise control to provide a safe environment conducive to learning?
- Are facilities readily accessible to people with disabilities?
- Are changing rooms, showers, or restrooms equitable for both genders?
- Has a safety checklist been completed for the student environment?
- Have appropriate measures been taken to protect the students and instructor from contamination resulting from injury or while treating an injury, including instructor training and health safety equipment?
- Are student safety tests indicating 100% accuracy on file for each student and evidence of hazardous material handling and right-to-know instruction retained on file to verify that appropriate training has taken place?
- Is a hazardous waste disposal system in place for the program where appropriate?

Applicable Standards for Building Construction

OCR's authority to consider accessibility comes from Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, and their implementing regulations. The specific subparts of the two regulations that address accessibility can be found at these two links:

- 34 C.F.R. Part 104, subpart C: http://www.ed.gov/policy/rights/reg/ocr/edlite-34cfr104.html#C
- 28 C.F.R. Part 35, subpart D: http://www.gpo.gov/fdsys/pkg/FR-2010-09-15/html/2010-21821.htm

Depending on the date that the initial construction or alteration commenced, the regulations as amended refer to three sets of design standards. The two sets of design standards that are available on line can be found at these two links:

- Uniform Federal Accessibility Guidelines (UFAS): http://www.access-board.gov/ufas/ufas-html/ufas.htm
- ADA Accessibility Guidelines (ADAAG):
- http://www.access-board.gov/adaag/html/adaag.htm

UFAS and/or ADAAG apply to new construction or alterations begun after January 17, 1991

The ***American National Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped***, (**ANSI** A117.1-1961 (R1971)), applies to **new construction and alteration begun between June 4, 1977 and January 17, 1991**, inclusive. This document is not available on line. The *ADA and ABA Accessibility Guidelines for Buildings and Facilities*, published in the *Federal Register* on July 23, 2004, has no force at this time and should not be used by your MOA agency to determine compliance.

If the facility is an "existing facility" under Section 504 (that is, **construction began before June 4, 1977**), then the program or service offered there must be ***readily accessible***, when viewed in its entirety, to persons with disabilities, regardless of any barriers within the facility.

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010

Architectural Barriers Checklist

District/Facility: _____ Date/Original Construction: _____ Date/Additional Construction: _____

1. Are there students who have visual impairments currently enrolled at the campus?
2. Are there students who have mobility impairments currently enrolled at the campus?
3. Are there students who have auditory impairments currently enrolled at the campus?

Applicable accessibility standards are determined by the date the facility was constructed or last renovated by the institution...
• *Existing facilities/§504 (34 CFR, 104.22) – Construction or alteration initiated before 6/4/1977 –* ***Readily Accessible (RA)*** – Mandatory Readily Accessible elements to monitor: Accessible parking; accessible entrance; accessible route to enter administration, nurse, & conference areas; at least one accessible restroom for each sex OR a single unisex accessible restroom; accessible drinking fountain if offered...
• *Construction/§504 (34 CFR 104.23) – Construction or alteration initiated between 6/4/1977 & 1/18/1991 –* ***American National Standards Institute (ANSI)...***
• *Construction/§504 (34 CFR 104.23) – Construction or alteration initiated on or after 1/18/1991 & 1/27/1992 –* ***Uniform Federal Accessibility Standards (UFAS)...***
• *Construction/ADA (28 CFR 35.151) – Construction or alteration initiated on or after 1/27/92 – present time -* ***Americans with Disabilities Act (ADA) Standards for Accessible Design; 7/23/2004 updated; 2010 updated & mandatory for new construction as of March 15, 2012...***

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
PA6: All LEA facilities housing programs are located at sites that are readily accessible to persons who are mobility, visually, or auditory impaired...						
PA6.1 PA6.2	Persons with disabilities can access parking facilities & buildings of the school system... Appropriate parking spaces are located closest to nearest accessible entrance on an accessible route...	No required # of parking spaces - # available based on parking needs... **A recipient shall operate its program or activity so that it is readily accessible to persons with disabilities – this does not require making every part of an existing facility accessible...**	Same as RA No required # of parking spaces - number available based on frequency & persistency of parking needs... Minimum clear width of accessible route shall be 36 inches...	Same as ANSI 1:25 = 1 26:50 = 2 51:75 = 3 76:100 = 4 101:150 = 5 151:200 = 6 201:300 = 7 301:400 = 8 401:500 = 9 501:1,000 = 2%	Same As UFAS 1,001 & over = 20, plus one of each 100 (or fraction thereof) over 1,000...	Same as ADA 1992/2004 Accessible routes shall coincide with or be located in the same area as general circulation paths – where circulation paths are interior, accessible routes shall also be interior...
PA6.3	Accessible parking spaces & access aisles	Standard accessible parking spaces shall be 8	Same as RA	Same as ANSI	Same as UFAS	Same as ADA 1992/2004

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
PA6.4 PA6.5	are level with surface slopes & do not exceed 2% grade... Number of designated parking spaces based on total number of parking spaces for the site... One parking space in every 6 (or 8) spaces is served by access aisle & designated as van accessible...	feet (96 inches) wide; there should be one van accessible parking space for every **Eight** accessible spaces; van accessible spaces shall be 11 feet (132 inches) total – 8 feet (96 inches) for the space & 3 feet (36 inches) for the access aisle – space & aisle shall be clearly marked to define width & to discourage parking in aisle... **Public Access**	Two van accessible spaces may share common access aisle... Standard accessible spaces shall be 12 feet (144 inches) wide; van accessible space that is 12 feet (144 inches) wide with open space on one side allowing room for individual using a wheelchair, providing a suitable area for wheeling, & clearly marked is adequate...	Standard accessible spaces shall be 8 feet (96 inches) wide plus 5 feet (60 inches) access aisle for van accessible parking space...	Parking spaces for vans, access aisles, & vehicular routes shall provide vertical clearance of 98 inches; standard accessible parking space @ 8 feet (96 inches); van accessible parking space plus access aisle shall be 16 feet (192 inches) wide total...	One van accessible parking space for every **SIX** accessible parking spaces; standard accessible parking space @ 8 feet (96 inches); van accessible parking spaces 11 feet (132 inches) wide with access aisle of 5 feet (60 inches); van accessible spaces permitted 8 feet (96 inches) wide where access aisle is 8 feet (96 inches) wide...
PA6.6	Curb ramps are provided whenever accessible route crosses a curb...	Curb changes (along accessible route) greater than ½ inch high shall be ramped. Curb ramp runs shall have a running slope not steeper than 1:12 – a slope steeper than 1:8 is prohibited. Minimum width of a curb ramp shall be 36 inches...	Same as RA Handrails are not required on curb ramps; built-up curb ramps shall be constructed so that they do not project into vehicular traffic lanes...	Same as ANSI Curb ramps shall be located or protected to prevent obstruction by parked vehicles...	Same as UFAS Curb ramps shall have a detectable warning extending full width & length of the curb ramp...	Same as ADA 1992/2004
PA6.7	Ramps & walkways used to access buildings meet accessibility standards...	PA6.7.1: Slope of ramp @ 2%; rise of ramp no greater than 30 inches... PA6.7.2: Width not less than 36 inches... PA6.7.3: Surface stable, firm, & slip resistant...	Same as RA A ramp shall not have a slope greater than 1 foot rise in 12 feet; ramps shall have level staging areas @ 30 foot intervals for purposes of rest & safety; ramps	Same as ANSI Any part of an accessible route with a slope greater than 1:20 shall be considered a ramp; staging area lengths shall be a minimum of 60 inches	Same as UFAS Staging/landing area length shall be @ least as wide as the ramp itself; if a ramp run has a rise greater than 6 inches or a horizontal projection	Same as ADA 1992/2004

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		PA6.7.4: Ramps have a level landing... PA6.7.5: Walkways are not uneven or impassable...	with gradients shall have a handrail 32 inches in height on @ least one side; ramps shall have landings @ the top & @ the bottom of each ramp run...	clear; handrails on both sides if rise is greater than 6 inches; outdoor ramps will be designed so that water does not accumulate on walking surface...	greater than 72 inches, then it shall have handrails on both sides; handrails are not required adjacent to seating in assembly areas...	
PA6.8	Doorway thresholds do not exceed ½ inch &/or is beveled...	Sharp inclines & abrupt changes in level shall be avoided at doorsills. As much as possible, thresholds shall be flush with the floor to provide public access...	Same as RA	Same as ANSI Thresholds @ doorways shall not exceed ¾ inch for exterior doors or ½ inch for other types of doors; raised thresholds & floor level changes at accessible doorways shall be beveled with a slope no greater than 1:2; if existing thresholds measure 3/4 inch high or less, & are beveled/modified to provide beveled edge on each side, they may be retained...	Same as UFAS Raised thresholds & floor level changes at accessible doorways shall be beveled with a slope no greater than 1:2...	Same as ADA 1992/2004 Thresholds @ doorways shall be ½ inch; thresholds in roll-type shower compartments shall be ½ inch; in transfer type shower compartments, thresholds @ ½ inch shall be beveled, rounded, or vertical...
PA6.9 PA6.10	Door handles do not require grasping, pinching, or twisting of wrist... Doors are adjusted to a maximum five	Door handles providing public access along accessible route for public entry; door handles along mobility impaired student's course schedule pathway... Door operation related to public access entry along	Same as RA Care should be taken in the selection, placement, & setting of door openers/closers so that they do not prevent the use of doors by persons with physical disabilities; maximum	Same as ANSI Handles, pulls, latches, locks, & other operating devices on accessible doors shall have a shape easy to grasp with one hand & does not require tight grasping, pinching, or	Same as UFAS	Same as ADA 1992/2004 Operable parts shall be operable with one hand & shall not require tight grasping, pinching, or twisting of the wrist...

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
	pound pull...	accessible route & mobility impaired student's course schedule pathway... **Public Access**	force for pushing/pulling open an interior/exterior door shall be: 5 lb.; sliding or folding doors: 5 Ib...	twisting of the wrist to operate; hardware required for accessible door passage shall be mounted no higher than 48 inches above finished floor...		The force required to activate operable parts shall be five pounds...
PA6.11	Accessible entrance & exit doorway...	Maximum threshold of ½ inch & minimum door width of 32 inches as measured below any existing panic bar to provide public access...	Same as RA Doors shall have a clear opening of no less than 32 inches when open & shall be operable by a single effort – exterior & interior doorways...	Same as ANSI Doorways shall have a minimum clear opening of 32 inches with the door open 90 degrees, measured between the face of the door & the stop...	Same as UFAS A minimum clear width of 32 inches will provide adequate clearance...	Same as ADA 1992/2004
PA6.12	Interior stairs are uniform & have handrails on both sides – open risers are not permitted...	Stairs that might require use by those with disabilities shall not have abrupt nosing; stairs shall have at least one handrail that extends 18 inches beyond the top step & beyond the bottom step to provide public access...	Same as RA Stairs shall have at least one handrail 32 inches high as measured from the tread at the face of the riser; low hanging signs, ceiling lights, & similar objects or signs & fixtures that protrude into regular corridors or traffic ways shall be avoided. A minimum height of 7 feet, measured from the floor, is recommended...	Same as ANSI Stairs not part of an accessible route... On given flight of stairs, steps have uniform riser heights & uniform tread widths – stair treads no less 8 inches wide; stairways have continuous handrails @ both sides... Detectable warnings @ stairs – moved from required to reserved status...	Same as UFAS An accessible route does not include stairs, steps, or escalators... Each stairway shall have a minimum clear width of 48 inches between handrails... Detectable warnings @ stairs remain in reserved status...	Same as ADA 1992/2004 All steps have uniform riser heights & tread depths. Risers 4 inches minimum/7 inches max – treads 11 inches deep minimum. Top of stair flight, handrails extend horizontally 12 inches minimum – @ bottom of stairs, handrails extend @ slope of flight for horizontal distance equal to one tread depth beyond last riser nosing...
PA6.13	Hallways & other passageways are @	Average turning space required (180 & 360	Same as RA	Same as ANSI	Same as UFAS	Same as ADA 1992/2004

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
	least 60 inches wide allowing wheelchairs to pass &/or turn around...	degrees) is 60 x 60 inches; low-hanging door closers that remain within opening of a doorway when door is open, or that protrude hazardously into regular corridors or traffic ways when the door is closed, shall be avoided to provide public access...	Minimum width of 60 inches required for individuals using wheelchairs to pass each other; there shall be no difference between level of floor of corridor & level of classroom or any other room, unless proper ramps are provided...	Objects projecting from walls with leading edges between 27 & 80 inches above floor protrude no more than 4 inches into circulation areas or spaces & shall provide 80 inches minimum clear head room...	If vertical clearance of an area adjoining an accessible route is reduced to less than 80 inches, a barrier to warn blind or visually-impaired persons shall be provided...	
PA6.14 PA 6.14.1 PA 6.14.2 PA 6.14.3 PA 6.14.4 PA 6.14.5	Elevators are on an accessible route & provide the following: Automatic operation... Door protective reopening device... Floor plan promoting wheelchair mobility... Control panel allowing selection by sight & touch... Controls can be reached from wheelchair height...	Elevators shall be accessible to, and usable by, persons with physical disabilities on the level that they use to enter the building, and at all levels normally used by the general public; doors shall be 32 inches wide minimum... **General Information Readily Accessible:** **All facilities & programs must: be located @ sites readily accessible to minority & nonminority communities; not identify facility or program as intended for nonminority or minority persons; provide equal access without regard to race,**	Same as RA Elevators shall allow for traffic by wheelchairs, in accordance with: Average turning space required is 60 x 60 inches; bilateral horizontal reach of individual using a wheelchair is 54 inches; diagonal reach is 48 inches... No mention of Braille in ANSI standards... If platform lifts are used, they shall facilitate unassisted entry & exit from lift... If provided, emergency communications shall	Same as ANSI Elevator operation shall be automatic; call buttons in lobbies or halls shall be 42 inches above floor; call buttons shall have visual signals to indicate when each call is registered & when answered – audible once for up & twice for down OR shall have verbal annunciators that say "up" or "down"; Braille characters can be used in addition to Alphabet characters & numbers... Elevator doors shall be 36 inches wide @ a minimum; doors shall automatically open &	Same as UFAS Elevators are not required in altered facilities less than three stories or less than 3,000 square feet per story; areas of Rescue Assistance or evacuation elevators may be included as part of accessible means of egress... All control buttons shall be Braille designated & have raised standard alphabet characters for letters, Arabic characters for numerals, or standard symbols & placed immediately left of control button; all elevator hoist way	Same as ADA 1992/2004 This section does not require installation of an elevator in an altered facility that is less that 3 stories or has less than 3,000 square feet per story... ADA & civil rights laws require accessible features maintained in working order, accessible to & usable by those intended to benefit – failure to effect repairs could constitute violation of Federal law... Call buttons/key pads comply with reach ranges; new construction elevators

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		color, national origin, gender, or disability; be readily accessible to students who are visually, mobility, or auditory impaired... Educational occupancy includes accessible use of building, structure, or services by six or more persons at any time for educational purposes through Grade 12... **Public Access**	be accessible & usable...	close; reopening device will stop & reopen door automatically when obstructed; if a safety door edge is provided in existing automatic elevators, automatic door reopening device may be omitted... Freight elevators not considered to meet requirements, unless only elevators provided used as combination passenger & freight elevators for public & employees... If provided, emergency communications mounted 48 inches max from floor of car with raised letters – voice communication not required...	entrances shall have raised Braille floor designations provided on both jambs... Elevator doors shall remain fully open in response to a car call 3 seconds minimum; elevator reopening time shall be 20 seconds minimum; elevator doors shall be 36 inches wide...	equipped with audible signals; sounds once for "up" & twice for "down" OR have annunciators that sound direction... Elevator doors shall be horizontal sliding type – car gates prohibited; existing elevators with manually operated doors have no requirement for reopening device... Cars provide 42 inches width; 54 inches depth; car doors @ narrow ends provide 36 inches width... Destination elevators provide tactile & Braille identification @ both jambs of hoist-way below floor designation...
PA6.15 PA 6.15.1 PA 6.15.2	Drinking fountains are accessible... Accessible to individuals who use wheelchairs... Accessible to individuals who	Water fountains or coolers shall be hand operated or hand & foot operated to provide public access...	Same as RA Conventional floor-mounted water coolers can be serviceable to individuals in wheelchairs if a small fountain is mounted on the side of the cooler 30	Same as ANSI If drinking fountains are provided, approximately 50% of those provided on each floor shall be on an accessible route...	Same as UFAS Spouts shall be no higher than 36 inches as measured from the floor to the spout outlet for a wheelchair accessible water fountain...	Same as ADA 1992/2004 Spout outlets for standing persons shall be 38 inches minimum & 43 inches maximum above the finish floor or ground; no fewer

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	cannot bend or stoop...		inches above the floor...			than two drinking fountains shall be provided...
PA6.16 PA 6.16.1 PA 6.16.2 PA 6.16.3 PA 6.16.4 PA 6.16.5 PA 6.16.6 PA 6.16.7	Bathrooms are accessible to persons who have disabilities... Required space to enter/leave toilet stalls for those who use a wheelchair... Entry door provides sufficient clearance... Entry door handle does not require grasping, pinching, or twisting of the wrist... Entry door swings away from clear floor space required for maneuverability... Grab bars are properly installed... Bathrooms are free of hazards... Faucet handles do not require grasping, pinching, or twisting of the wrist...	Toilet rooms shall have space to allow traffic of individuals using wheelchairs... Readily Accessible, & ANSI toilet stalls are not the same as UFSAS, ADA 1992/2004 or ADA 2010 toilet stalls... Entry doorways shall have minimum 32 inches clearance; entry door handle does not require grasping, twisting, or pinching to operate... **Public Access** Grab bars should not have sharp or abrasive edges... Any handle or operating device does not require grasping, twisting, or pinching to operate...	Same as RA No difference between level of corridor & toilet room floor... Toilet rooms shall have @ least one toilet stall 3 feet wide, @ least 56 to 60 inches deep, stall door @ least 32 inches wide that swings out, handrails (grab bars) on each side, water closet with seat @ least 20 inches from floor... Toilet room provides average turn space of 60 by 60 inches... Any mirrors & shelves provided above lavatories – height low as possible; no higher than 40 inches above floor, measured from	Same as ANSI Accessible toilet stalls shall be 60 inches wide with minimum depth of 59 inches with floor mounted commode – 56 inches for wall mounted... Accessible toilet stalls shall be on an accessible route... Grab bars should be mounted on both sides or on at least one wide side & at back of the stall – 33 to 36 inches from floor & of appropriate length & a diameter of 1 ¼ to 1 ½ inches mounted 1 ½ inches from wall...	Same as UFAS Entry doors & toilet stall doors shall not swing into clear floor space required for any fixture...	Same as ADA 1992/2004 Toilet stall doors shall be located in front partition or side wall (or partition) farthest from water closet; stall doors shall not swing into minimum required compartment area...

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PA 6.16.8	Mirrors are properly installed...	**Public Access**	the top of shelf & bottom of mirror....	For individual using wheelchair: forward reach = high of 48 inches; side reach = high of 54 inches...	Toilet tissue dispensers installed within reach...	Toilet tissue dispensers shall not be located behind grab bars & shall not be of type that controls delivery or does not allow continuous paper flow...
PA 6.16.9	Dispensers properly installed, do not require grasping, pinching, or twisting of wrist...		Towel racks/dispensers mounted no more than 40 inches from floor; dispensers do not require grasping, pinching, or twisting to operate...			
PA 6.16.10	Unisex bathrooms are installed with a locking device...		The words commode, faucet, restroom, bathroom, or unisex are not found in ANSI...	Unisex toilet rooms shall be equipped with a privacy latch...		
PA 6.16.11	Push type faucets adjusted to minimum water flow...		Toilet rooms shall have lavatories with narrow aprons, mounted 19 inches from floor & usable by individuals using wheelchairs; drain pipes under accessible lavatory shall be covered or insulated so individual will not be scraped or burned; wall mounted urinals have basin opening 19 inches from floor OR floor mounted urinals on floor level...			
PA 6.16.12	At least one bathroom sink installed at correct height with appropriate knee clearance...					
PA 6.16.13	Exposed pipes under sinks are wrapped...			Stall type or wall hung urinal mounted @ maximum 17 inches from floor...		
PA 6.16.14	Urinals are stall type or wall hung & properly installed...			Water closets shall be 17 to 19 inches measured from floor to top of toilet seat...		Clearance around a water closet & in toilet compartments @ 60 inches minimum re: perpendicular measure from side wall; 56 inches minimum re: perpendicular measure from rear wall...
PA 6.16.15	Commodes installed @ proper height...					
PA 6.16.16	Flush handles installed @ wide side of commode...			Flush valves mounted on wide side of toilet areas no more than 44 inches above floor...		

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
PA6.17 PA 6.17.1 PA 6.17.2 PA 6.17.3 PA 6.17.4 PA 6.17.5	Areas listed are physically accessible... Office/administration area... Nurse's clinic... Auditorium... Gymnasium & locker facilities... CTE dressing/shower facilities...	Raised letters or numerals used to identify rooms or offices; office entry door, clinic, & conference shall 32 inches wide; office & clinic entry doors shall be equipped with accessible door handles; Braille should be enforced due to public access... Assembly occupancies shall include areas of public access for persons who have physical disabilities; accessible route shall lead to fixed or built-in seating areas... In lieu of no required number of seats - recommendation is to follow ADA standard due to public access...	Same as RA... Room or office identification should be placed on the wall to the right or left of the door @ a height measured from the floor @ 60 inches... Wheelchair areas shall be integral part of fixed seating plan; dispersed throughout seating area; adjoin accessible route that also serves as egress in case of emergency; & located to provide lines of sight comparable to those for all viewing areas... No required number; Recommendation is to follow ADA standard... Lockers shall be provided in easily accessible areas for use by individuals with disabilities... CTE dressing/shower facilities not required & when provided seldom used – CTE students no longer routinely change	Same as ANSI... UFAS first standard to mention Braille, wording is: "Braille characters can be used in addition to standard alphabet characters & numbers..." 50:75 = 3 76:100 = 4 101:150 = 5 151:200 = 6 201:300 = 7 301:400 = 8 401:500 = 9 501:1,000 = 2% Over 1,000 = 20 plus 1 for every 100 over 1,000... Recommend follow ADA standard rather than enforce UFAS required seating... Shower seat shall be provided in shower stalls 36 X 36 inches, mounted 17 to 19 inches from floor, extend full depth of stall, & mounted on wall opposite controls; clear floor space that allows forward or	Not 100% same as UFAS... Raised lettering/numerals accompanied by Grade 2 Braille @ latch side of doors (when possible) sixty inches from floor to middle of signage... 4:25 = 1 26:50 = 2 51:300 = 4 301:500 = 6 over 500 = 6 plus 1 additional space for each seating capacity increase of 100; in addition, 1% (but not less than one), of fixed seats be aisle seats with no aisle side armrests (or removable/folding aisle side armrests)... Each accessible seating area shall have provisions for companion seating & shall be located on accessible route that serves as means of emergency egress...	Same as ADA 1992/2004... Assembly areas that require dispersing of wheelchair spaces & companion seats, & have seating encircling performance area or field of play, shall disperse wheelchair seating & companion seats throughout... 4:25 = 1 26:50 = 2 51:300 = 4 301:500 = 6 501:5,000 = 6 plus 1 for each 150, or fraction thereof, between 501 & 5,000; 5,001 & over = 36 plus 1 for each 200, or fraction thereof over 5,000... Wheelchair spaces shall be integral part of seating plan; companion seats are comparable to seating in immediate area & can be movable... Each designated seat shall be identified by a

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
			clothes other than into smocks/aprons, etc...	parallel approach by person using wheelchair shall be provided @ dispensers, controls, receptacles, & other operable equipment; a shower spray unit with hose @ least 60 inches long that can be used as fixed shower head or hand held shower shall be provided; grab bar installation not required unless facility occupied by elderly or persons with severe disabilities who are unsupervised... Accessible route shall allow for wheelchair passage to/from performing areas such as stages, arena floors, dressing rooms, locker rooms, & other spaces used by performers...	Grab bars shall be provided @ accessible shower; fixed shower head mounted @ 48 inches above shower floor may be used in lieu of hand held shower head; examples of types of dressing rooms are those serving different genders or distinct & different functions...	sign or marker; consider identifying such seats with signs designed to contrast (light on dark or dark on light) & are also photo luminescent...
		Public Access				
PA 6.17.6	Computer laboratory...	Accessible computer lab required when scheduled pathway includes student with disabilities...	Words computer & laboratory not found in ANSI standard; look for availability of adjustable tables or individual computer desk if needed...	Facilities (including laboratories) that include public access will be accessible...	Where there are a series of individual work stations, at least one to be constructed so individual with disabilities can maneuver within work station...	

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
			Accessible entry door & door handle; raised letters/numerals identifying area...	**Educational occupancy includes accessible use of building, structure, or services by six or more persons at any time for educational purposes through Grade 12...**		
PA 6.17.7	Counseling & Guidance areas...	Public access required as with office area...	Same as RA through ADA 2010 to provide public access...		At least one Library checkout lane area @ 36 inches minimum length & max 36 inches height from floor; minimum clear aisle width between stacks 42 inches...	
PA 6.17.8	Library...	Written plan covers Readily Accessible & ANSI when library stacks are higher than forward &/or side reach allowances...	Average unilateral vertical reach 60 inches & ranges from 54 to 78 inches; word library not found in ANSI standard...	Library shelf height is unrestricted by UFAS; however, forward reach – max high forward reach @ 48 inches; max high side reach @ 54 inches by person using a wheelchair...	At least 5% of fixed tables/counters shall be accessible & where practical dispersed throughout; knee space minimum 27 inches high, 30 inches wide, & 19 inches deep; tops from 28 to 34 inches above finish floor; using accessible areas not restricted to people with disabilities...	ADA 1992/2004 & 2010 restricts library shelf height to allowable forward & side reach ranges...
PA 6.17.9	Cafeteria...	**Public Access**	There shall be no difference in level of corridor floor & of meeting room, dining room, or any other room, unless proper ramps are provided...	The dining area shall be accessible & on an accessible route; food service lines shall have minimum 36 inches clear width; tray slides max 34 inches from floor...		Where dining surfaces are provided for consumption of food or drink; at least 5% of seating spaces @ dining surfaces shall include: clear floor space; knee & toe clearance; top or counter @ 26 inches minimum/30 inches max above floor; an accessible route shall be provided to all areas including raised, sunken, & outdoor dining areas; tops of tray slides minimum 28 inches wide & 34 inches above floor...
PA 6.17.10	Science classrooms & laboratories...	Along student with disabilities scheduled pathway – science lab & CTE classrooms & labs shall be accessible including Family Consumer Science (FCS)	Along student with disabilities scheduled pathway – science lab & CTE classrooms shall be accessible...	All areas (including laboratories) shall be accessible for student with disabilities along scheduled pathway; faucet handle @ designated lab station	Where there are a series of individual work stations, at least one to be constructed so individual with disabilities can maneuver within	
PA 6.17.11	CTE classrooms & laboratories...					

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
PA 6.17.12	Agricultural area...	laboratory... Along student with disabilities scheduled pathway – agricultural area shall be accessible...	Along student with disabilities pathway – agricultural area access shall be accessible...	shall not require grasping, pinching, or twisting of wrist... Along student with disabilities pathway – animal or farm area access shall be accessible...	work station; Agricultural area access, as with all educational areas constructed under ADA standards shall be accessible...	Within animal containment area, floor/ground surfaces not required to be stable, firm, & slip resistant...
PA 6.17.13	Music, choir, dance rooms, & band hall...	Public Access if required... Along student with disabilities scheduled pathway – music areas shall be accessible...	Along student with disabilities scheduled pathway – music areas shall be accessible...	Along student with disabilities scheduled pathway – music areas shall be accessible...	Music, choir, dance room, & band hall shall all be ADA accessible...	Music, choir, dance room, & band hall shall be accessible...
PA 6.17.14	Other public areas (specify)...	**Public Access**	Same as RA...	Same As ANSI...	Where sports fields or courts are provided, accessible route required to each field or area of sport activity...	Grandstands, arenas, & stadiums: wheelchair spaces & companion seats are dispersed to all levels that include seating served by accessible route; press boxes on accessible route unless area of press box @ 500 sq. feet max; at least 1 accessible space provided in team/player seating area serving areas of sport activity...
PA6.18	Area of rescue assistance...	Located on an accessible route – applicable to multi-story facilities... Recommend review of evacuation plan for fire, tornado, &/or disaster as well as evacuation team assignments; in buildings where individuals with	Same as RA... Recommend review of local Fire Marshall & Insurance Board requirements for school evacuations... TASB policy FFF (Legal & Local)	Same as ANSI... Accessible routes serving accessible space shall serve as means of egress for emergencies or connect to area of rescue assistance; accessible routes &	Same as UFAS... Area, with direct exit access, where those unable to use stairs may remain temporarily safe to await further instruction/assistance during emergency	Same as ADA 1992/2004... Areas of Refuge <u>Advisory</u>: Areas of refuge include fire-rated spaces above or below exit discharge levels

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
		disabilities are served, an emergency management plan for evacuation plays an essential role in safety for everyone... **Public Access**	Student Welfare Student Safety...	areas of refuge shall comply with requirements of administrative authority having jurisdiction... If provided, emergency communications shall be accessible & usable...	evacuation; each area of rescue assistance shall be identified by a sign: "AREA OF RESCUE ASSISTANCE" & displays international accessibility symbol:  Exception: Areas of rescue assistance not required in buildings or facilities having a supervised automatic sprinkler system...	where people unable to use stairs can go to register a call for assistance & wait for evacuation; some elevators rated fire/smoke proof & can serve as areas of refuge... Communication shall be provided between area of rescue assistance & primary entry; Fire Dept. (or local authority) may approve different location than primary entrance... A light can be used to visually indicate assistance is on the way; if so, signs indicating visual signal meaning should also be provided...
PA6.19	Written plan for Readily Accessible facilities... TASB policy CS (Legal) Readily Accessible Programs & TASB policy GA (Legal) Nondiscrimination...	Board adopted to ensure students with disabilities have access & opportunity to participate in general education curriculum including school's programs, activities, & services & provide student scheduled pathway access...	Written plans do not supersede ANSI standards for accessibility in spite of limitations of ANSI standards...	Written Plans do not supersede UFAS standards for accessibility...	Written plans not applicable to ADA standards for accessibility – ADA construction requires total accessibility whether school currently serves student/students with disabilities or not...	Same as ADA 1992/2004

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
PA23: Signage is provided at all LEA entrances to facilities directing users to accessible entrances (where needed) or to location @ which information can be obtained about accessible facilities. Signage is appropriately placed @ parking areas, exits, elevators, restrooms, classrooms, & stairways...						
PA 23.1	Permanent signs made of non-glare material; matte finish or slightly rough to the touch...	Low hanging signs, ceiling lights, & similar objects or signs & fixtures that protrude into regular corridors or traffic ways shall be avoided. Minimum height of 7 feet as measured from floor recommended...	Same as RA...	Same as ANSI...	Same as UFAS Characters & background of signs shall be eggshell, matte, or other non-glare finish...	Alterations to windows, hardware, controls, electrical outlets, & signage not deemed as alterations that affect usability of or access to area containing a primary function...
PA 23.2	Parking spaces designated by posted sign showing symbol of accessibility...	Accessible spaces approximate to facility set aside & identified for use by individuals with physical disabilities; care in planning should be exercised so that persons with disabilities are not compelled to walk behind parked cars to provide public access...	Same as RA... Texas Accessibility Standards (TAS) requires parking signs @ 60 inches above ground; only height enforced by Federal standards @ RA, ANSI, UFAS, & ADA is signage visible above vehicle in space...	Same as ANSI... Signs designating parking spaces for people with disabilities can be seen from driver's seat if mounted high enough above ground & located @ the front of a parking space...	Elements & spaces of accessible facilities identified by symbol of accessibility are: Reserved parking spaces for individuals with disabilities; accessible passenger loading zones; accessible entrances when not all are accessible; accessible toilet facilities when not all accessible...	Signs shall include international symbol of accessibility & be 60 inches minimum above floor or ground surface as measured to bottom of sign; parking spaces & access aisles shall be designed so that parked vehicles do not obstruct required 36 inch clear width of accessible route...
PA 23.3	Designated signage for individuals with disabilities that is not obscured by vehicle parked in space...	Van accessible parking space with access aisle adjacent/parallel to space; must comply with PA6.5 RA & marked appropriately for van accessible; van accessible parking spaces are not limited to vans only...	Accessible spaces designated as reserved for persons with disabilities by sign showing symbol of accessibility & not obscured by vehicle parked in space... Van accessible spaces comply with PA6.5 ANSI & marked van		Spaces must comply with PA6.5 ADA; signs located so they cannot be obscured by vehicle parked in space...	ADA 2010 now agrees with Texas Accessibility Standards (TAS) – Signs shall include international symbol of accessibility & be 60 inches minimum above floor or ground surface as measured to bottom of sign...

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
			accessible & mounted below posted symbol of accessibility...			
PA 23.4	Permanent direction signage identifies accessible entrances (where needed)...	Permanent direction signage identifies accessible entrances (where needed) to provide public access...	Same as RA...	Same as ANSI... Signage positioned perpendicular to the path of travel is easiest to notice...	Entrances not accessible shall have directional signage indicating location of nearest accessible entrance & shall be positioned at/near inaccessible entry so that individual with disabilities will not have to backtrack...	Same as ADA 1992/2004 Where directional signage required, placement should be so as to minimize backtracking...
PA 23.5	Permanent direction signage identifies accessible routes within buildings (where needed)...	Permanent direction signage identifies accessible routes within buildings (where needed) to provide public access...	Same as RA... Particular identification of specific facilities within building used by public particularly essential to visually impaired...	Same as ANSI... Signage displayed horizontally should be no higher than 44 inches above floor surface; interior signage located alongside door on latch side & mounted at a height of 60 inches above floor to middle of sign...	Same as UFAS... Signage positioned perpendicular to the path of travel easiest to notice; people can generally distinguish signage within an angle of 30 degrees to either side of the face without moving their head...	Where existing toilet rooms are not accessible, directional signs indicating location of nearest accessible restroom shall be provided; Signage displayed horizontally should be no higher than 48 measured from floor to baseline of lowest tactile character & 60 inches to baseline of highest character...
PA 23.6	Signs identifying permanent rooms or spaces have raised upper-case characters accompanied by Grade 2 Braille...	Signs identifying permanent rooms or spaces have raised upper-case characters accompanied by Grade 2 Braille to provide public access...	Same as RA...	Same as ANSI... Letters & numbers on signs shall be raised, incised, or indented...	Characters/numbers on signs to be sized according to viewing distance from which they are read & will be accompanied by Grade 2 Braille...	Same as ADA 1992/2004 Signs designed to be read by touch should not have sharp or abrasive edges...

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
PA 23.7	All sign characters have letters, numbers, & symbols contrasting highly with sign's background...	All sign characters have letters, numbers, & symbols contrasting highly with sign's background to provide public access...	Same as RA...	Characters & symbols shall contrast with background either light on dark or dark on light...	Same as UFAS...	Signage characters shall be sans serif, uppercase, & not italic, oblique, script, highly decorative, or other unusual forms...
PA 23.8	Permanent signs for identification provided for rooms/spaces...	Permanent signs for identification provided for rooms/spaces & installed @ wall on latch side of door 60 inches from floor to middle of sign to provide public access...	Same as RA...	Same as ANSI...	Same as UFAS...	Permanent signs for identification provided for rooms/spaces & installed @ wall on latch side of door 60 inches from floor to middle of sign...
PA 23.9	Accessible restrooms have appropriate signage...	Permanent signs for identification provided for rooms/spaces & installed @ wall on latch side of door 60 inches from floor to middle of sign for public access...	Same as RA...	Same as ANSI...	Same as UFAS...	Permanent signs for identification provided for rooms/spaces & installed @ wall on latch side of door 60 inches from floor to middle of sign...
PA 23.10	LEA provides public information regarding availability of seating for persons with disabilities in public areas such as gyms, auditoriums, & stadiums...	**For purposes of accessibility, school assembly areas include classrooms, lecture halls, meeting rooms, theaters, performing arts, amphitheaters, labs, arenas, stadiums, convention centers, gyms, dressing rooms, field houses, grandstands, & fields of play...** **Public Access**	Same as RA... Seating signage shall be required for public information @ public assembly areas such as theaters, arenas, gymnasiums, stadiums, grandstands, bleachers, centers for performing arts, auditoriums, & convention centers...	Same as ANSI...	Same as UFAS... Seating signage shall be required for public <u>as well as student</u> information @ public assembly areas such as theaters, arenas, gymnasiums, stadiums, grandstands, bleachers, centers for performing arts, auditoriums, & convention centers...	Same as ADA 1992/2004

Ind. #	Descriptor	RA	ANSI	UFAS	ADA 1992/2004	ADA 2010
PA6 For the future or for today?	Research areas related to further accessibility requirements for future inclusion in Program Access Reviews (PAR) – or for current inclusion...	Hearing Aid Compatible & volume control telephones...	Assistive Listening Systems in assembly areas; Audio Amplification...	Text Telephones (TTYs) – aka: Telecommunications Device for the Deaf (TDD)...	Detectable Alarms; Warning Signals; Audible & Visual Alarms; Auxiliary Alarms; illuminated EXIT signage...	Open for input to consider adding, editing, &/or deleting through feedback from the floor &/or supervision resulting from application...

TRADE & Industrial Education

Facility Guidelines

Instructional Materials Service

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Trade and Industrial Education
Facilities Guidelines

Introduction

The *Trade and Industrial Education Facility Guidelines* provides information regarding the physical requirements for some of the most popular T&I instructional programs. The purpose of this publication is to guide teachers, administrators, architects, and other professionals in building or converting Trade and Industrial Education instructional laboratories to train students in the knowledge, skills, and processes commonly found in today's industry. However, these guidelines do not purport to be all-inclusive. These guidelines are designed to begin answering the questions that normally arise during the construction or remodeling of Trade and Industrial facilities. Teaching styles, the desired facilities, and the nature of the programs will dictate adjustments and additions to any program recommendations.

To the extent possible, the recommendations in this publication came from national program standards, such as those from National Automotive Technician Education Foundation (NATEF) or the American Welding Society (AWS) and the Associated General Contractors (AGS) for the facility, equipment, and tool recommendations. However, national program and facility standards were not available in all Trade and Industrial clusters or program areas, so recommendations from community colleges, other states, and/or teachers were used in the development of these guidelines.

Some aspects of all Trade and Industrial education programs and facilities are similar in nature; a brief discussion of each of these similarities follows. Subsequent sections focus on the unique requirements of individual courses within each of the seven Trade and Industrial Clusters.

Facility Design for Flexibility and Expandability

Designing school facilities is a challenge; providing desirable learning environments for the myriad of trade and industrial education programs includes particularly complex issues, as industry is constantly changing. Trade and Industrial Education facilities have at least two important characteristics.

The first characteristic is the high cost of space and equipment, relative to most other teaching spaces in a school. Most laboratories may require up to six times more space than required for academic teaching space. Equipment costs for some programs may be a hundred times greater.

Second is the inflexibility of some laboratory designs. Facilities for some Trade and Industrial Education programs require a large floor space with a high ceiling and special wiring, plumbing, air handling, and acoustical treatment. These facilities may be expensive to renovate and poorly located for other uses. It is, in general, easier to convert outdated laboratories into other laboratories than into spaces for academic use.

Flexibility is an important concept in planning laboratory facilities. A modular system of layout permits the greatest possible exchange of workstations and other laboratory work areas. Modular lighting, heating, air conditioning, and ventilation will allow reduction or expansion of spaces without affecting the environment. The use of non-load-bearing partitions between adjoining areas increases the flexibility of laboratory areas. Position utilities on permanent walls and structural components.

Future expansion using multiples of needed workstations rather than general additional square footage extend the useable life of a facility and more simply accommodates changes in programs and curricula. The site configuration is an important consideration in minimizing restrictions to additions and renovation to the existing building.

Flexibility encourages space sharing that increases utilization of existing facilities and reduces costs. Dressing rooms, showers and clothing locker areas, where required can be shared effectively. Multiple laboratories sharing a common work or fabrication areas is an additional approach to space sharing.

Trade and Industrial Education Training Spaces

The following identifies design considerations that are common to most Trade and Industrial Education program facilities.

Classrooms

Each Trade and Industrial program requires access to classroom space sufficient for anticipated student enrollments. Safety glass windows provide a clear view of the laboratory area while providing acoustical insulation of the classroom from the laboratory noise. Control of natural light is necessary to permit the use of television and other audiovisual media. Classroom lighting needs to consider the needs of students with visual disabilities, as well as the use of media.

The typical classroom space has a dry marker and tack boards, adequate seating equipment, teacher desk with chair, and a demonstration/planning table. Ample built-in storage for audiovisual equipment and materials, printed instructional resources, and teacher-maintained student files are important to providing classroom instruction.

Tables and chairs are preferable to traditional student desks because of their flexibility in meeting a variety of instructional needs and strategies. Computer workstations with Internet access are an integral part of classroom instruction.

Laboratories

Trade and Industrial laboratories are custom designed for specific classes or programs and provide a simulated-work environment for the practical applications of instruction and skills practice, effectively and safely. The unique purposes and nature of instruction in the specific program determine the floor area; however, a minimum of 100 square feet per student, exclusive of storage and other support areas, is a good planning figure. Ceiling heights will range from 12'0" to 14'0" depending on the square footage of the laboratory. Each laboratory should have a communications system, including a telephone, for informational and emergency use.

Carpeting is an appropriate floor treatment for light-duty laboratories and in areas where noise control is desirable, such as drafting. Vinyl tile is effective for light-duty areas such as electronics and cosmetology, where maintenance is likely to be an issue. Medium to heavy-duty laboratories generally have hardened, sealed concrete floors, as they are often subject to abuse from heavy equipment and oils and acid. Floor drains are necessary in areas subject to spilled liquids or where floors are scrubbed or hosed down. Where spillage of volatile liquids is likely, drains should have suitable interceptors.

Tool and supply storage should be convenient to work areas to minimize travel and congestion. There should be wide aisles between workstations, in front of storage cabinets, and around equipment. Equipment such as lathes, planers, or presses have a tendency to vibrate and will need to be bolted to the floor. Mounting pads placed under the machine feet also reduce vibration.

Machines and equipment should be located to allow for ease of cleaning around the base, and cabinets should fit flush to walls for the same purpose. Walls should be smooth with no ledges to collect dust in those areas that generate dust. Laboratories that generate excessive dust or other airborne pollution must have an exhaust system.

Windows can provide natural lighting which, at times, may be sufficient for student activities and thereby reduce energy cost. Natural lighting is also advantageous in circumstances where color distortion from artificial lighting is an issue and for a way out of the building during power failures or other emergencies. Windows are necessary in laboratories or rooms housing hazardous equipment. Natural ventilation may be sufficient during much of the school year, can reduce energy costs, and is useful when mechanical systems fail.

Windows may not be practical in medium and heavy-duty laboratories with expensive equipment or tools, due to the security issues they generate. If regular windows are impractical, small, inoperable windows high above the floor and glazed with wire glass or covered with grilles are an option. Windows should be a minimum of 48 inches above the floor and 72 inches where wall space is valued. If windows are used, orientation of the building on the site should reduce glare.

Teacher Office/Conference

Teachers should have an office/conference room that has a desk or lighted desk-height work surface with a computer terminal and telephone, chairs, file cabinet, and storage for teaching

materials and personal items. The teacher's office/conference area should be adjacent to the classroom and laboratory and the adjoining wall made of glass so that the teacher can observe activities within the classroom and laboratory while in the office.

Storage Areas

Storage is required for tools, materials, student work, and teacher materials and supplies. Storage rooms can isolate noisy laboratories from adjacent quiet areas. Inexpensive tools, equipment, or utensils frequently used can be stored on wall panels or cabinets for easy accessibility and inventory. The more expensive items, especially those used occasionally, require a lockable room or cabinet.

Materials storage requirements vary with the types of activities, but should be located convenient to the materials receiving door and should provide an orderly flow of materials into the laboratory work areas. Storage should accommodate materials necessary for the programs. For example, lumber comes in lengths up to 20', while steel stock is 20 feet in length and steel pipe is 21 feet long. For security reasons, tool and materials storage rooms should not have windows or skylights. Masonry wall construction and doors without louvers are appropriate. Storage should also be available for safeguarding student work and projects.

Outdoor Spaces

Spaces outside the building are essential to the successful implementation of certain Trade and Industrial education programs, either as staging or instructional areas. Such spaces are tailored to meet the needs of the curriculum of specific courses or programs. These spaces include outdoor storage for welding and automobile storage spaces for Automotive Technology or Collision Repair and Refinishing.

Lighting

A well-lit laboratory includes both natural and artificial lighting. An artificial lighting system should provide a uniform distribution of shadow-free, glare-free illumination of the laboratory. In addition to ceiling-mounted fixtures, supplemental lighting may be necessary for some pieces of equipment. Illumination levels will vary with activities; however, in general, 60-100 foot-candles is appropriate for classroom and general laboratory areas and 200 foot-candles is adequate for laboratories where close or detailed work is performed, such as in a drafting laboratory.

Local lighting should be used for certain activities, such as grinding and machining operations. Lighting systems must also be designed so that stroboscopic effects, which would make turning machines appear to be still, are not present.

A uniform color scheme should be used throughout the laboratory. Ceilings should be white. Walls should reflect about 60%- 70% of the light that strikes them.

Electricity

An electrical system for a laboratory should be planned after the identification of the equipment and where it is to be located. However, planners need to assume that changes will occur from time to time in the use of the facility.

Duplex receptacles (120-volt) should be located at 12' intervals on perimeter walls and should be placed 48" above the floor. Double duplex outlets should be located on columns. Where debris on the floor is common, outlets mounted in cast boxes on rigid conduit at least 12" above the floor are recommended. Outlets, which must be placed on the floor under student furniture, should be in surface-mounted, tombstone fixtures.

In medium to heavy-duty shops where equipment is often driven by electric motors, 208- or 240-volt, three-phase current should be provided. Magnetic switches should be installed on equipment with large motors. Where flexibility in equipment location is desirable, overhead drop cords are generally more flexible than the expensive overhead bus duct system. The instructor will need to be able to disconnect each piece of equipment from its power source; therefore, the use of outlets for each machine is appropriate.

As a safety factor, the instructor should be able to disconnect and lock the electrical service to all equipment from a master panel that is easily accessible. Code all machinery at the power panel so the circuit can be killed quickly in an emergency. Automotive or other laboratories where volatile liquids or vapors will be present require special safety considerations. State and local building codes should be consulted.

Security and Safety

Security in Trade and Industrial Education facilities and equipment is of primary concern from economic, accountability, and liability perspectives. The design of the facility should assure controlled access to classroom, file server, laboratory, and support areas.

No consideration in facility planning is more important than safety. While various points related to safety are alluded to throughout this publication, the following are specific points to consider:

1. Machinery should be located to allow the operator protection from traffic patterns.
2. Kickback areas for machines should be oriented away from student work areas.
3. Electric equipment should not be located near sinks or water fountains.
4. Welding booths and curtains should be fire proof or fire resistant. Exhaust hoods should be provided in welding areas. Curtains on booths should adequately screen the welding area.
5. An engine exhaust system should be provided in automotive areas.
6. Motors, switches, and electric fixtures located in spray booths should be explosion-proof.
7. U.L.-approved safety containers should be provided for flammable liquids and rags.
8. Storage cabinets for eye protection devices should be provided.

9. Eyewash fountains should be provided where students or staff are likely to get chemicals or debris in their eyes. Emergency showers may be needed in some laboratories.

School planners should keep abreast of current statutes and codes related to building and occupant safety as they relate to the design of Trade and Industrial Education programs and facilities.

See Appendices for information on Safety Zones and Color Coding and OSHA Regional Offices.

Determining Space Requirements

The development of instructional space needs can no longer be determined by calculating the total number of square feet needed per student times the number of students. Changes in curriculum, equipment, and instructional tasks require a facility that can adapt to change in the curriculum reflected by the changes in industry.

School planners need to take in consideration the (1) space required to carry out the goals and objectives of the program, (2) the equipment necessary to complete the objectives, and (3) additional space adequate to provide a safe instructional environment.

The calculation of space requirements should be based the following:

1. The adopted student-teacher ratio maximum (recommended not to exceed 22 students per laboratory class);
2. The type of activity to be performed and the frequency of that particular activity.
3. Safe working conditions, with adequate space around each piece of equipment relative to the learning activity being performed;
4. The required working, storage, and assembly areas.
5. The size, quantity, and type of equipment used in the industry.
6. The size of the related classroom/instructional area.
7. The area required for instructor's offices.
8. The amount of space necessary for each student workstation.
9. Storage space for projects, materials, visual aids, tools and portable equipment, files and reference books.
10. Space for students of both sexes to change their clothing, to clean up, and to store personal belongings.
11. Any additional requirements necessary for instruction of special education students.
12. Other auxiliary space needed to meet curriculum needs, industry-standards, and the types and shapes of project development.

To establish accurate space requirements, the teacher should:

1. Prepare a list of equipment for each work/training station.
2. Prepare a list of each auxiliary item of equipment.
3. Prepare scale models or templates of each item of equipment.
4. Attach each model/template to the model/template of the work areas and necessary safety space.

5. Prepare models/templates of required work, and assembly or demonstration areas that do not include equipment.
6. Prepare models of auxiliary space requirements such as storage spaces.
7. Place models/templates on planning board with consideration for such factors as work flow, distribution of work/training stations, visibility, safety, traffic, materials handling, relationships of probable mechanical and utility service locations, consistent with standard industry practices.

Selection of Equipment

The program goals and objectives determine equipment needs. While the teacher is the logical source of information regarding equipment and tools, the program advisory committee is an excellent resource for this important activity. While the advisory committee's services are unofficial, their recommendations and opinions should carry the weight of practitioners with industry experience.

The tools and equipment should be of the type, size, and purpose to that used by the industry. To facilitate the acquisition of the necessary program equipment, a workstation list of tools and a list of auxiliary tools will be helpful. It is helpful to everyone in the planning process, if the lists contain the following information:

1. Name and type of equipment
2. Size and capacity
3. Attachments and accessories
4. Electrical and/or other utility specifications
5. Preferred manufacturer and model
6. Delivery costs
7. Estimated installation cost
8. Life estimate, depreciation, and maintenance allowance

Schools should provide for equipment maintenance in the planning stage of facilities planning and before the money is expended.

General Considerations for Trade and Industrial Education Facilities

General considerations in connection with trade and industrial education programs include, but are not limited to the following:

- Corridor doors into laboratories and related classrooms should be wide enough to accommodate large items of equipment other than the machinery used for instruction.

- General and specific illumination in all areas should be appropriate to the instructional/learning tasks of the specific program and over-all facility design to provide balanced lighting conditions.

- There should be a master key for main laboratories and related classroom, but special keys for auxiliary rooms in each laboratory.

- Fire extinguishers should be located in all laboratory/shop areas and should be appropriately distributed according to local fire codes.

- The master power panel in each laboratory should be situated in a convenient location; it should be designed and/or located so that only the instructor or an authorized person can turn the power on/off.

- Master emergency "stop" switches should be located in a number of convenient locations in laboratories utilizing electrically powered equipment. Emergency disconnect switches should be in place for all equipment and outlets except lights.

- Adequate provisions are made for the handling and disposal of environmentally and biologically hazardous materials.

- Air compressors serving the laboratories should be mounted separately, if possible, outside the building to eliminate vibration and prevent noise interference with instruction and/or communication.

- Circuits for hazardous machines and tools in laboratories/shops should be controlled via "kill switches" with pilot lights.

- Classrooms should be arranged for ease of monitoring by staff and should include visual access to the laboratory and, in some instances, to the corridor.

- Placement of windows five feet or more above the floor of the laboratory/shop increases the amount of useable wall space.

- All electrical outlets should be polarized.

- Concrete floors in the laboratory areas should be treated and toweled smooth.

- Plan "expansion joints" in concrete floors so equipment with small casters can be moved about easily. Sawed joint or equivalent preferred.

- Plan for an appropriate sonic environment in laboratories.

- Air handling should be adequate for the type of instruction conducted.

- Safety measures should meet or exceed state and federal requirements.

- Major aisles should be four feet wide.

- A minimum of three feet on each side of stationary power machinery is recommended.

- Machines normally used for rough stock should be placed near the material storage area; this reduces the hazard of moving large pieces of stock through the laboratory.

- Special attention should be given to the direction of chip throw or kickback and these danger zones marked.

- Machines that exceed four feet in height should be placed in close proximity to walls to avoid obstructing the teacher's vision.

- Emergency eyewash and/or showers should be provided in each T&I laboratory area, as appropriate.

Organization of Specific Facilities Recommendations:

Specific facility, equipment, and tools recommendations are organized by the Trade and Industrial Education seven (7) systems and forty-six (46) general course or industry categories.

Because laboratory layouts will vary depending on funds available, resources, equipment needs, space requirements, workflow, and safety operating procedures, layouts are not provided, only the recommended facility, equipment, and tool needs.

Specific recommendations are provided for those programs in bold type.:

1. **Communication and Media Systems:**
   Advertising Design
   Architectural Drafting
   Architectural Interior Design
   Commercial Photography
   Computer-Aided Drafting
   Graphic Communications Technologies (Graphic Arts/Printing)
   Mechanical Drafting (Drafting)
   Media Technology

2. **Construction-Maintenance Systems:**
   Building Maintenance
   Building Carpentry
   Concrete Laying and Finishing
   Painting and Decorating
   Building Electrical Trades
   Heating, Ventilation, Air Conditioning, and Refrigeration (HVAC-R)
   Masonry Trades

Mill and Cabinetmaking
Piping Trades and Plumbing

3. **Electrical/Electronic Systems:**
   Business Machine Repair Services
   Industrial Electronics
   Major Appliance Repair Services
   Computer Technologies (Electronics and Computer Maintenance Technician
   Instrumentation
   Telecommunications Services.

4. **Industrial and Manufacturing Systems:**
   Ceramic Manufacturing
   Foundry Operations
   Hydraulics and Pneumatics
   Petrochemical Processing
   Plant Maintenance
   Plant Processes
   Plastics Technology
   Power Technology
   Quality Control

5. **Metal Technology Systems:**
   Machine Shop
   Metal Trades
   Sheet Metal,
   Welding

6. **Personal Service Systems:**
   Cosmetology Services
   Furniture Repair and Upholstery Services
   Leather Trades Services
   Protective Services.

7. **Transportation Systems:**
   Aircraft Services
   Automotive Services
   Automotive Collision Repair and Refinishing Services
   Diesel Services
   Marine Services
   Small Engine Services,

A coordinated **work-based learning** component at the local level provides students opportunities for on-the-job training through cooperative education, internships, apprenticeship training, and preceptorships in each of the forty-six general course or trade categories. Mentorship and job shadowing provide supplemental training experiences.

References

American Welding Society. *Guide for the Design of a Welder Training Facility*, Miami, FL, 1998.

The Associated General Contractors of America. *Industry Guidelines for Vocational Education Construction Craft Programs*

North Carolina Department of Public Instruction. *Workforce Development Education Facilities Planner*. Raleigh, NC, 1997.

Deluca, V. William and W. James Haynie, III. Safety System Design for Technology Education, International Technology Education Association, Reston, VA, 2000.

Communication and Media Systems

Drafting

Recommended Drafting Laboratory/Classroom Facility for a maximum of 24 students:

Type/Use of Area	Recommended Square Footage
Laboratory/Classroom	1800-2400
Storage Area, lockable (supplies, tools, equipment)	200
Teacher Office/Conference	150
Clean-up/Lockers – Boys	40-50
Clean-up/Lockers – Girls	40-50
Emergency eyewash and drench shower	16 minimum

Special Considerations:

1. Deep sink with hot and cold water supply.
2. Appropriate ventilation for Diazo printer
3. 100-foot candles of artificial lighting required for drawing.
4. Perimeter electrical outlets above counter height.
5. Accessible to local school network and Internet.
6. Light dimmers near teacher station for use of projectors and T.V. monitors

Equipment and Materials List
Basic Drafting

Adjustable triangle
Ames-type lettering guide
ANSI standards for drafting
Blueline pencil machine
Braddock Rowe triangle
CADD software with operator's manual
CADD system hardware
Cleaning pad
Common templates (circle, arrowhead, etc.)
Compass
Computer work stations
Computer projection device
Counter space for a size "A"-"D" plotter or printer, a Diazo reproduction machine and paper cutter
Diazo paper
Diazo print machine
Divider
Drafting machine or parallel bar
Drafting tables to accommodate "C" paper and stools
Drafting tape

Drawing media (vellum and polyester film)
Drawing storage (large) with shallow drawers; one set per class recommended
Electrostatic (xerigraphic) machine
Erasers for ink and pencil
Erasing brush
Erasing shield
Film cleaner and cloth
Ink
Ink filler bottle
Irregular curves
Lead (various weights)
Lead holder or mechanical (mm) pencil
Lead pointer
Leroy-type lettering instrument (optional)
Lint-free cloth or tissue
Metal rule
Microdisk (high density, 1.4MB)
Pen cleaning solution
Plotter or printer, size "D"
Plotter paper
Protractor
Safety gear
Scales: architect, metric, civil, mechanical
Standard fit tables
Standard triangles, 30º, 60º ,45º
Storage shelves for drawing and reproduction media up to size "D" sheets
Storage shelves for student models and projects
Storage for Diazo machine filters and ammonia
Teacher drawing table
Technical pen set

Recommended Drafting Tool Kit

Lead holder/pencil
Protractor
Lead pointer
Eraser
Erasing shield
30-60-90 Triangle
45-45-90 Triangle
Drafting Tape
T-square/parallel bar
Architect's scale
Engineer's scale
Metric scale
Civil scale

Instrument set (compass, divider, etc.)
Lettering guide
Templates (circle, arrowhead, etc.)
Drafting tape
Dusting brush
Dusting powder

Graphic Arts/Printing

Facility

Type/Use of Area	Recommended Square Footage
Laboratory	2000-2800
Classroom/Instruction	700*
Storage	600
Storage for flammables	
Darkroom	200
Teacher Office/Conference	150
Clean-up/Restroom/Lockers – Boys	40-50
Clean-up/Restroom/Lockers – Girls	40-50

* State requirement, Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities

Special Considerations:

1. Should be located on a ground level floor, with direct outside access for moving large equipment and printing supplies
2. Should have zoned temperature control
3. Computer workstations with printers and scanner
4. Adequate ventilation
5. Dedicated telephone line for Internet access
6. Hot and cold water supply
7. High pressure spray booth for screen printing, if applicable
8. Interior walls windowed
9. Overhead power access to 240V
10. Acoustical ceiling tile
11. Compressed air
12. Anti-glare exterior light source
13. Non-glare classroom lighting
14. Emergency disconnect switch for all equipment and outlets except lights

Tools, Equipment, and Materials List

The following are required beginning basic tools and may change and expand to keep pace with changing technology, industry, and curriculum.

Orientation, Composition, and Paste-Up
Black ink
Black paper
Burnishing roller
China marking pencil
Clean-up solvents
Clear acetate film and rubylith
Computers: monitor, CPU, keyboard, mouse
Cotton pads, clean
Developed offset plate
Drawing boards or light tables
Eraser
Find-tipped black pen
Grid or base sheets
Laser printer
Line gauge
Masking tape
Mechanical films
Non-reproducing light blue pencil or pen
Opaque white paint or correction fluid
Phototypesetting machine
Plain white or coated paper
Preservatives
Processor and chemicals
Proportional scale
Rubber cement
Ruler, metal
Tissue or tracing paper
Triangle
Trim board
T-square
Type image carrier
Vertical camera
Water bottle
Waxer
Work table
X-Acto knife
Electronic Prepress and Publishing
Backup utility and user's manual
Black-and-white photographs to be scanned

Blank CDs
Calculator
CD burner
CD burning software and user's manual
Continuous tone color image
Density guide or densitometer
Disk labels
Eight-page document
Electronic clip art
EPP document and instructions
EPP magazines and newsletters
File compression utility and user's manual
Floppy disks
Font-management software and user's manual
Graphics to be scanned
Illustration software and user's manual
Image-editing software and user's manual
Imagesetter and film processor
Internet access
Line art to be scanned
OCR software and user's manual
Page-layout software and user's manual
Paper, 11" x 17" or 12" x 18"
Pen and pencil
Preflight software and user's manual
Printer (laser or inkjet)
Processed film (from imagesetter)
Proportional scale
Removable mass storage or tape drive
Removable media
Scanner, flatbed
Scanning software and user's manual
Scan target, gray ramp, or imagesetter test sheets
Telecommunications software and user's manual
Type gauge
Word-processing software and user's manual

Process Camera, Stripping, and Platemaking
Absorbent paper
Acetate overlays
Activator
Amberlith or rubylith
Black fine and medium point pens
Black felt tip pens
Black photographic tape
Blueline or daylight copy proofing material
Bond
Cardboard
Card stock, various colors and white
Cheese cloth
Color key
Contact film
Contact frame/vacuum printer
Contact screens
Darkroom equipment
Darkroom timer
Developer
Diffusion transfer activator
Diffusion transfer gray contact screen
Diffusion transfer negative paper
Diffusion transfer processor
Diffusion transfer receiver paper
Duplicating film
Film hole fitters
Filter holder
Filters
Fixer solution
Flash lamp, 7 ½ watt bulb
Flats
Glass cleaner and wipes
Graduate
Graphic arts film
Graphic file
Gray scale
Halftone film
Illustration board
Kodak Color Separation Guide
Kodak Direct Screen Calculator, 1-10B
Kodak Q15 Exposure Computer
Kodak 24-Step Reflection Density Guide, 1-16
Litho film
Magnifier, 10-power

Masking sheets, ruled and unruled
Masking tape
Negatives
Offset plates
Opaque brush and solution for opaquing pen
Panchromatic film
Paper pad
Paper towels
Paste-up equipment
Photo-direct platemaker
Plate exposure device
Plate processing chemicals
Pre-angled chipboard
Pre-sensitized subtractive plate
Process camera
Protractor
Register marks
Register punch and pins
Scissors
Screwdriver
Sink
Spacer material
Sponge or pad applicator
Squeegee
Stop bath
Storage containers
Stripping equipment
Stripping knife
Tape dispenser
Templates
Text file
Thermometer
Transparent tape
Trays
Triangle
T-square
Vacuum exposing unit
The Press and Finishing Processes
Abrasive cleaner
Adhesive perforation and scoring material
Adjustment wrench
Allen wrench
Blanket powder
Bond paper
Box end wrench

Carbonless paper
Chipboard
Center punch
Chrome cylinder cleaner
Cleanup mats
Cleanup solvent
Collator
Dampening gauges, .005
Deglazer
Degreaser
Distilled water
Electronic pH meter
Envelop stock
Folding machine
Fountain solution
Ink knife
Ink scale
Installation sleeve
Jogging machine
Mixing containers and tools
Molleton cover, new
Offset blankets
Offset plates
Offset press with operator's manual
Offset press inks (various colors)
Padding brush
Padding compound
Padding press with operator's manual
Paper stock (variety)
Paper cutter
Paper drill with operator's manual
pH test strips
Photo-direct and/or electrostatic plates
Plate cleaner
Plate etch
PMS color formula guide
Preservatives
Press with additional color head
Press with operator's manual
Printed press sheet
Roller conditioner-cleaner
Saddle stitcher
Scoring machine
Shop towels
Solvent/oil mixture
Sponge rubber buffer

Standard tools
Stapler
Standard tools for additional color head
Talcum powder
Water miscible cleaner
Wood block

Construction-Maintenance Systems:

The Associated General Contractors of America (AGC) provides the following guidelines to assist in the planning and implementation of Construction-Craft programs.

Facility Types. The types of facilities required for a training program will depend upon the type of training offered and on the number of students in training. The training facilities must be accessible to the population being served and should include a classroom, laboratory, tool and material storage area, and an office for the teacher(s). Facilities should provide a large enough space for special skill projects. Facilities should have adequate lighting and air circulation; the office and classroom should have sufficient heat and air conditioning to maintain an environment conducive to working and learning. The entire facility should be organized with security in mind. To the extent possible, the facility should provide an environment as similar as possible to that found on the job site.

Facility Space and Equipment. Facility space and equipment must effectively accommodate the number of students to be included in the program, the teacher(s), and any required support staff. Facilities and equipment inventory must reflect stated program training goals and objectives. Duplication of essential tools and equipment is necessary so that all students will have ready access to them at all times.

Safety Provisions. Adequate provision must be made for the safety of the students and the instructional staff.

Laboratories. It is crucial that laboratories for construction-craft programs are designed to simulate the industrial setting. The equipment must duplicate that used in the industry, and the training conducted on live or simulated projects, as much as possible. Future expansion and adaptability of the programs should be included in the planning/design phase. The size of the laboratories will depend on the program and on the training objectives of the program. Careful planning will permit maximum usage of the laboratory. Most trade and industrial programs require as much wall space as possible. Wasted wall and floor space are as expensive as usable space.

Teacher's Office. AGC recommends that each teacher have office space available. Office space should not be part of the laboratory or the classroom. It is best if one wall of the office adjoins the laboratory area and that the adjoining wall be glass so that the teacher can observe activities within the laboratory while in the office.

Classroom. AGC recommends that the classroom be separate from the laboratory but adjacent to it to permit ease of demonstrations with equipment and to require a minimum of students' time in travel from the classroom to the laboratory.

Personal Facilities. Personal facilities such as restrooms, locker area, and washrooms are a vital part of the total program facility. AGC recommends that personal facilities be close to the laboratory area to allow teacher supervision and to help eliminate possible

discipline problems. Large wash fountains that will accommodate up to six people are normally preferred, and it is advisable to locate wash-up areas within the laboratory itself.

Facilities for Students with Disabilities. It is important to keep in mind the needs of students with disabilities in order to make the facilities as accessible and usable for these students as possible. Each program will need to purchase, adapt, or modify any equipment needed for students with disabilities.

Lighting. The lighting should be planned to substantially reduce the energy consumed by the lighting system while still providing students with the quality and quantity of illumination required to perform their tasks. Effective lighting must be achieved in a manner consistent with student and program requirements, such as productivity and visual comfort; aesthetics, and federal, state, and local codes and ordinances. AGC recommends the Illumination Engineering Society's *IES Lighting Handbook* as the most appropriate resource to determine lighting for trade and industrial programs.

Teaching Aids and Equipment. The training program must be equipped with appropriate teaching aids, audiovisual equipment, and electronic equipment. The quantity of this type of equipment depends on the number of students.

General Building Trades

Facility

AGC recommended general Building Trades facility to accommodate 16-20 students:

Type/Use of Area	Recommended Square Footage
Laboratory	2200-2800
Outside construction area/project site	5000
Classroom/Instruction	700*
Storage (materials and equipment)	750
Tool room	200
Finish room	600
Teacher Office/Conference	150
Clean-up/Locker-room	200

* State requirement, Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities

Other Space Considerations:

- Laboratory design should facilitate supervision of students.
- Assembly space is required to allow construction of trusses, wall sections, door units, etc.
- Doors and entryways should facilitate use of wall space.
- Space around machinery and work areas should allow for traffic flow.
- A simulating area is required to allow for framing, wiring, plumbing, and masonry projects.

Climate-control Considerations:

- AGC recommends evaporative cooling with rust-prevention maintenance required on machine and tools.
- Room temperature should be kept at an acceptable level to enhance learning.

Noise-control Considerations:

- Classroom should be isolated from laboratory by location, insulation, or other sound proofing means.
- Equipment-noise levels should conform to OSHA noise-level regulations.

Vibration-control Considerations:

- Floor-mounted and wall-mounted machines should be equipped with vibration-dampening devices.

Illumination Considerations in finish area:

- Explosion-proof light fixtures are required.
- Recommended lighting level is 150 foot-candles at 30 inches off floor.

Plumbing Considerations:

- Water plumbing required in the following areas:
  Service sink in wood-gluing area required hot- and cold-water plumbing.
  Finish room requires cold-water plumbing.
  Water fountain requires cold-water plumbing.
  Hose bibb near overhead door requires cold-water plumbing
  Washbasin in clean-up area requires hot-and cold-water plumbing.
- Compressed-air plumbing required in the finish room as per the following:
  1 outlet regulated from 0psi to 50 psi
  4 outlets regulated from 0psi to 120 psi
- 3-inch minimum diameter drain required in the following areas:
  Finish room
  Clean-up area
  Masonry area

Communication Requirements:

- Telephone located in teacher's office; signal must be audible in laboratory areas; sound must be audible when machines are in use.
- Intercom located in teacher's office, in laboratory, and in classroom; sound must be audible when machine are in use.
- Bell/alarm system located in classroom and in laboratory; sound must be audible when machines are in use.

Electrical Requirements:

- Outlets, 120-volt, on 12-foot centers, located 48 inches above floor level.
  Note: If three-phase outlets are not used, 120-volt and 240-volt must be used.
- Motors must be over ½ horsepower, 240-volt, three-phase or 208-volt.

Electrical-system Recommendations:

- Overhead bus bars, most flexible, 120- and 240-volt
- In-floor grid, least flexible, 120- and 240-volt
- Master-switch shut-down should provide easy access for emergency shut-down system.
- Means of locking "power off" completely.

Security Requirements:

- Security locks required in laboratory, material storage area, supply room, and teacher's office.
- Burglar alarm system required throughout facility.
- 10-foot chain link fence with 6-foot double gates required for outside construction area.

Windows, Doors, and Floor Requirements:

- Windows on outside walls must be located a minimum of 72 inches above floor level.

- Window or glass walls on inside partitions must be placed a maximum of 42 inches above floor level.
- Sliding mesh window and counter required in tool crib.
- All interior doors must be arranged for safe and efficient traffic flow when door is open.
- Service door, 10 'x 12', is required for material an storage areas.
- Personnel door should be located adjacent to the service door.
- Double doors with no center support required in finish area, construction area, and tool storage area.
- Sealed concrete floors required in laboratory.
- Nonskid flooring material required around machines and in masonry area.

Aesthetic Requirements:

- Walls should have a 6' wainscot of glazed brick, tile, epoxy paint, or semi-gloss enamel.
- Ceilings should reflect light and absorb sound.
- Ceilings should adhere to 12' minimum height guidelines.

Service-area Requirements:

- Overhead door should be located so that it is convenient to assembly area and construction-tool storage.
- Access drive to overhead door required for material and project loading and unloading.
- Parking space should be adequate for bringing or removing projects or materials.

Safety Requirements:

- Safety precautions must be adequate for providing a safe environment for students and teacher.
- Approved fire extinguishers required in all areas of facility.
- Metal cabinets required for storage of flammable liquids.
- Approved self-closing metal containers required for storage of oily waste or rags.
- Fire blanket should be located in finish room.
- Exhaust system required to discharge fumes and dust.
  Note: An explosion-proof system is required in the finish area.
- Overhead exhaust systems recommended in all facility areas.
- Traffic lanes should be marked and left uncluttered.
- Cabinet for safety glasses required for sanitizing goggles and glasses.
- Lockable storage required for storage of hazardous materials.
- Safety glass required for doors, windows within 12 inches of doors, and window walls.
- Sprinkler and fire-detection systems required as specified by state fire codes.

Power Tools and Equipment

A well-equipped, general Building Trades program should have all of the following tools and equipment for general laboratory work. They should be readily available and in sufficient quantity to provide quality instruction.

The following are required beginning basic tools and may change and expand to keep pace with changing technology, industry, and curriculum

Radial-arm saw, 12”
Band saw, 20”, 1 horsepower, 240-volt, 3-phase
Table saw, 10” heavy-duty
Contractor’s saw, 10”
Brick saw
Tilting-arbor saw, 10”, 3 horsepower, 240-volt, 3-phase
Masonry saw, 14”, 3 horsepower, 120/240-volt
Jointer, 8” long bed, 1½ horsepower (minimum), 240-volt, 3-phase
Shaper, with various cutters
Surface planer, 18” x 6”, 5 horsepower, 240-volt, 3-phase
Bench grinder, 6”, ½ horsepower, 120-volt
Dado head
Hammer/tacker staple gun
Drill press, 15”, 1 horsepower, 240-volt, 3-phase
Trowel, gasoline, 44” diameter, 3-horsepower
Mortar mixer, 5½ horsepower, 120/240-volt
Air compressor, 60-gallon tank, 5 horsepower, 240-volt, 3-phase
Dust-collection system (connected to all woodworking machines), 240-volt, 3-phase
Exhaust fan (for finish room), explosion-proof, 24”, ½ horsepower, 120-volt
Saw blades: 7¼”, 10”, and 12”
Electric Hand Tools
Portable circular saw
Reciprocating saw
Belt sander, 3 x 21
Sanders: vibrator, bloc, and belt/disc
Compressed-air nailers, finish, box, and staple
Screw gun
Air hose, 3/8” x 50’
Rotary hammer drill
Hinge-butt router template
Portable power plane
Miscellaneous Equipment
Four-station work bench with vise, 1½”, maple top
Glue-clamp bench, 30” x 72”

Electrical work bench
Plumbing work bench
Rebar storage rack
Lumber storage rack
Plywood storage rack, flat storage required
Pipe storage rack
Extension cords: 25", 50", and 100'
Power supply, 4-way
Step ladders: 6', heavy duty; 8'; 10', heavy duty
Extension ladder, 24'
Scaffolding set, 5'
Woodworking vise
Shop table, hardwood-topped

Hand Tools and Equipment

Hammers: claw, trim, frame, shop, ball-peen, and cross-peen
Sledgehammer
Saws: 8- and 10-point, coping, and keyhole
Hacksaw
Pipe wrenches: 10", socket set, Allen wrenches, and combination end wrench set, ¼" to 1 1/8"
Screwdrivers: #1, #2, and #3 standard
Screwdrivers: #1, #2, and #3 Phillips
Torx®-head screwdriver -lock
Pliers: 8" standard, lineman, long-nosed, channel
Vise grips, 10"
Utility knife
Putty knife
Butt gauges: 3½" and 4"
Square-head (Roberson's) screwdriver
Side-cutting pliers
Combination slip-joint pliers
Adjustable wrench
Pipe wrench
Spud (structural) wrench
Ratchet and sockets
Squares: combination, tri-, and framing
Steel framing square, rafter-table
Aluminum walk boards
Levels: 24", 48", torpedo, line, and aluminum – 24" and 48"
Builder's level
Mason's level, 48"
Shovels: square-point, D-handled scoop; round-point, long-handled scoop; and square-point, long handled
Spade (sharp shooter)

Bolt cutter
Wrecking bar
Metal snips
Mattock/grubbing hoe
Pick
Roofing hatchet
Half-hatchet
Axe
Sawbuck (sawhorse)
Bench vise
Wheelbarrow
Brick and tile barrow
Planes: block and jack
Hand brace
Brace bits, set
Wrecking bar, 30”
Wonder bar
Cat claw
Steel measures: 50’ and 100’
Tape measure, ¾” x 16’
Files; various sizes
Rasps: various sizes
Scratch awl
Sliding T-bevel
Nail set, 1/32
Lock set kit
Wrenches: adjustable, open-end, 12” and pip, 14”
Pliers: slip-joint and plug-nose
Dresser, diamond-point
Drill bits, 1/32” to ½”
Wood bits, ¼” to 1”
Wood chisels, ¼” to 1”
Expansion bit
Hydraulic jack, 5-ton

Specialty Tools

Painting/staining equipment
Airless sprayer
Spray guns/cups
Paint pot
Filter/regulator
Fresh-air breathing system
Concrete tools
Trowels: 12” x 3”, 12” x 4”, 14” x 4”
Margin trowels, 5” x 2”

Wood darby: 30” and 48”
Magnesium darby, 30”
Magnesium float, 16” x ½”
Wood float, 18” x 1½”
Rubber or cork float, 8” x 4”
Magnesium bull float, 42” x 8” with six sections of 6” fiberglass handles
Fresno trowel with handles: 24” to 30”
Jitterbug tamper, 36” or 46”
Jointer (groover), 6” x 4½” with 1” bit
Edgers: 6” x 2½” with 3/8” radius; 6” x 3½” with 3/8” radius; and 6” x 4” with ½” radius
Concrete rake, come-along, or placer with handles
Masonry (scaling) hammer
Rubbing brick, 8” x 3½” x ¾”
Knee pads
Nylon texture broom, 18” to 36”, long-handled
Wire texture broom, 36”, long-handled
Exposed-aggregate broom
Floor squeegee, rubber
Water hose: 50’ lengths with regular and fogging nozzles
Buckets: 3-gallon and 5-gallon
Concrete saw, 6-horsepower or larger
Air-compressor, portable
Dry-Wall Tools
Dry-wall compound mixer
Dry-wall T-square
Taping knife
Finishing knives
Mud pan
Corner trowel
Dry-wall sanding tool
Shoe jack
Hawks
Stilts
Acoustical hopper and gun
Banjo
Baby duster
Commercial Forming Tools
Pre-fab wall forming system
Column clamps
Turn buckles
Steel stakes
Wire heads
Purlin splicers
Snap ties

Shore clamps, Ellis
Scaffold brackets
Cam locks
Grasshoppers
Surveying Equipment
Builders level
Transit
Tripod
Leveling rod
Plumb bob
Safety Equipment
Hard hats
Safety glasses
Goggles

Masonry Trades

Facility

AGC recommended Bricklaying facility to accommodate 15-20 students:

Type/Use of Area	Recommended Square Footage
Laboratory plus storage bins for sand, brick, etc. A portion of the floor space consists of a dirt floor.	4000
Outdoor construction area	2000-4000
Storage (tool and small equipment)	300
Storage	200
Classroom/Instruction	700*
Teacher Office/Conference	150
Clean-up/Lockers – Boys	300
Clean-up/Lockers – Girls	300

* State requirement, Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities

Other Space Considerations:

- Space around projects should allow for adequate traffic flow.
- Room design should facilitate supervision.
  Note: Avoid blind spots. Office and classroom should have glass walls facing the laboratory area.
- Door and entryways should facilitate use of wall space.
- Project area should provide adequate space for required projects and practice.
- Facility should be located close to other construction-trades facilities.

Climate-control Considerations:

- Classroom and laboratory should be air-conditioned to keep room temperature at an acceptable level to enhance learning.
- Laboratory should be heated to maintain temperature at 68 degrees during winter months.

Noise-control Considerations:

- Classroom should be isolated from laboratory by location, insulation, or other sound proofing means.
- Noise levels should be kept as low as possible; all equipment should conform with OSHA noise-level requirements.

Illumination Considerations:

- Recommended lighting level for general tasks is 50 to 70foot-candles at working surfaces.

Plumbing Considerations:

- Water plumbing required at the following areas:
  Clean-up area requires hot-and cold-water plumbing.
  Laboratory requires floor drain with sand trap.
- Compressed-air plumbing requires an outlet regulated to 100 psi.

Communications Requirements:

- Telephone located in the teacher's office, signal must be audible in the laboratory.
- Intercom located in teacher's office and in laboratory.
- Clock located in laboratory and classroom.

Electrical Requirements:

- Wall outlets, 110-volt on 12-foot centers, located 48" above floor level.
- Special outlets
  110-volt, 100-amp
- 220-volt, 30-amp

Utility Considerations:

- Dust collectors
- Closed circuit television
- Personal computer

Security Requirements:

- Security locks required in laboratory, material storage area, supply room, and teacher's office.
- Burglar alarm system required throughout facility.
- 10-foot chain link fence with 6-foot double gates required for outside construction area.

Window, Door, and Floor Requirements:

- Windows on outside walls must be located a minimum of 72 inches above floor level.
- Window or glass walls on inside partitions must be placed a maximum of 42 inches above floor level.
- Arrange all interior doors for safe and efficient traffic flow when door is open.
- Service door, 10' x 12', is required for material an storage areas.
- Personnel door should be located adjacent to the service door.
  Note: All walk-in personnel doors should be 40".
- Materials storage-bin doors should provide access from outside service area as well as from inside laboratory.
- Floors: sealed, hardened-concrete, deal-level floors are required in the laboratory.

Aesthetic requirements:

- Walls should have a 6' wainscot of glazed brick, tile, epoxy paint, or semi-gloss enamel.

- Ceilings should reflect light and absorb sound.
- Ceilings should adhere to 12’ minimum height

Service-area Requirements:

- Overhead door should be located so that it is convenient to assembly area and construction-tool storage.
- Access drive to overhead door required for material and project loading and unloading.
- Parking space should be adequate for bringing or removing projects or materials.

Safety Requirements:

- Safety precautions must be adequate for providing a safe environment for students and teacher.
- Approved fire extinguishers required in all areas of facility.
- Metal cabinets required for storage flammable liquids.
- Approved self-closing metal containers required for storage of oily waste or rags.
- Exhaust system required to discharge fumes and dust.
- Traffic lanes should be marked and left uncluttered.
- Approved goggles or glasses required for every student.
- Glasses cabinet required for sanitizing goggles and glasses.
- Lockable storage required for storage of hazardous materials.
- Safety glass required for doors, windows within 12 inches of doors, and window walls.
- Sprinkler and fire-detection systems required as specified by state fire codes.

Power Tools and Equipment

A well-equipped Bricklaying program should have all of the following tools and equipment for general laboratory/shop work. They should be readily available and in sufficient quantity to provide quality instruction.

The following are required beginning basic tools and may change and expand to keep pace with changing technology, industry, and curriculum.

Masonry saw, 14" or 20"
Portable masonry saw
Portable tile saw
Portable quick-cut saw
Concrete saw
Skill saw
Blades, carborundum, all sizes
Blades, diamond, all sizes
Skill-saw blades
Drill, ½" and , 7/8
Hammer drill
Mortar mixer
Tuck-pointer grinder
Welder, electric
Troweling machine
Fork lift
Dump flatbed, 1-ton

Hand Tools and Equipment

Note: The following are required beginning basic tools and may change and expand to keep pace with changing technology, industry, and curriculum.

Bricklayer's Hand Tools and Equipment
Tool bag or toolbox
Skate rake
S-jointers, Concave and V
Sled runner, Concave
Sled runner, V
Level, 2' and 4'
Brick set
Chalk line
Mason's line
Line blocks
Line pin and trigs
Trowel, pointing
Brick hammer

Tuck-pointer assortment
Rule, modular
Rule, brick spacing
Steel measure, 100’
Pencil
Hand saw
Rubber gloves
Tin snips
Plumb bob
Chisel, cold
Chisel, plugging
Tile marker
Ceramic/Tile Hand Tools and Equipment
Tile cutter
Trowels, V-notch, all sizes
Trowels, square-notch, all sizes
Hand float, rubber
Nippers, carbide-tipped
Chisel, ¼”, 3/8”, carbide-tipped
Tile hammer, carbide –tipped
Rubbing stone
Aluminum level, 30”
Laboratory Equipment
Shovels, round-point, short-handled and square-point, short-handled
Mortar hoe
Mattock/grubbing hoe
Pick
Pry Bar
Sledgehammer
Brick tongs
Scraper
Mortarboard stand and boards
Mortar box
Brick and tile barrow
Brick dolley
Manual lift pulley
Rope
Ladder
Scaffolding and scaffold planks
Story poles
Speed leads
C-clamps
Acetylene cutting torch
Hydraulic stone cutter

Soap stone
Builder's level
Mechanical maintenance-tool assortment
Wire brush
Acid brush
Shop broom
Rubber boots
Gas can, 2-gallon
Water hose
Extension cord, 100'
Brick, Block, Tile, and Stone Supplies
Common brick
Face brick, king-sized and modular
Lightweight blocks, all sizes
Concrete blocks, all sizes
Decorative blocks, all types
Glass blocks, all sizes and types
Wall and floor tiles (for wet and dry areas), all sizes
Structural tile, all types
Mortars (mastics), dry-set, all types
Grout, all types
Stone, all types (rubble, cut, precast, slate, marble, granite)
Concrete all types
Lumber Supplies
Plywood for mortarboard, ¾"
Scaffold planks, 2" x 12" x 10', #2 yellow pine or better
Mixing Materials
Masonry cement
Portland cement
Hydrated lime
Sand
Gravel
Hardware cloth (for screening)
Steel Supplies
Angle iron, all sizes
Anchor and foundation bolts, all sizes
Rebar (for reinforcement), all sizes
Wall Ties Supplies
Cavity-joint reinforcement, various sizes
Corrugated veneer, various sizes
Dovetail anchors, various sizes

Rectangular ties, various sizes
Z-ties, various sizes
Miscellaneous Supplies
Flashing materials, all types
Flue-lining materials
Line nylon
Nails, assorted sizes
Waterproofing compound
Cleaning solution

Concrete Laying and Finishing

Facility

AGC recommended Concrete Masonry facilities for 16-20 students.

Type/Use of Area	Recommended Square Footage
Laboratory	3600
Equipment Storage room	400
Materials storage room	400
Outdoor construction area	5000
Classroom/Instruction	700*
Teacher Office/Conference	150
Clean-up/Locker area	100

* State requirement, Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities.

Other Space Considerations:

- AGC recommends that one-half of the floor space consist of dirt floor.
- Avoid blind spots. Office and classroom should have glass walls facing laboratory area.
- Assembly space required for the construction of wall sections, forms, etc.
- Doors and entryway placement should facilitate use of wall space.
- Space around power equipment should allow for traffic flow.

Climate-control Considerations:

- Evaporative cooling recommended, with rust-prevention maintenance required on machines and tools.
- Heating and air-conditioning should be provided in classroom and teacher office areas to keep room temperatures at acceptable levels to enhance learning.

Noise-control Considerations:

- Classroom should be isolated from laboratory by location, insulation, or other sound proofing means.
- Equipment should conform to OSHA's noise-level regulations.

Illumination Considerations:

- Lighting levels should be adequate to meet requirements for both daytime and nighttime uses in laboratory, classroom, and storage areas.

Plumbing Considerations:

- Water Plumbing:
  Hose bibb near mixing area requires both hot-and cold-water plumbing.
  Finish area requires cold-water plumbing.
  Water fountain requires cold-water plumbing.

Hose bibb near overhead door requires cold-water plumbing.
Washbasin in clean-up area requires both hot- and cold-water plumbing.

- Compressed-air Plumbing:
  1 outlet regulated from 0 psi to 50 psi and equipped with a water separator.
  4 outlets regulated from 0 psi to 120 psi
- Floor drain required in laboratory.

Communications Requirements:

- Telephone located in the teacher's office, signal must be audible in the laboratory.
- Intercom located in teacher's office and in laboratory.
- Clock located in laboratory and classroom.
- Bell/alarm system located in classroom and laboratory must be audible when machines are in use.

Electrical Requirements:

- 110-volt, 200-amp outlets located conveniently throughout laboratory.

Security Requirements:

- Security locks required in laboratory, material storage area, supply room, and teacher's office.
- Burglar alarm system required throughout facility.
- 10' chain-link fence with 6' double gates required in outdoor construction area.
- Windows on outside walls must be located a minimum of 72 inches above floor level.
- Window or glass walls on inside partitions must be placed a maximum of 42 inches above floor level.
- Sliding mesh window and counter required in tool crib.
- Arrange all interior doors for safe and efficient traffic flow when door is open.
- Service door, 12' x 14', is required in laboratory.
- Personnel door should be located adjacent to the service door.
  Note: All personnel doors should be 48".
- Double doors with no center support required in finish area, construction area, and tool-storage area.
- Laboratory floors are required to be sealed, hardened concrete.

Aesthetic requirements:

- Walls should have a 6-foot wainscot of glazed brick, tile, epoxy paint, or semi-gloss enamel.
- Ceilings should reflect light and absorb sound.
- Ceilings should adhere to 12' minimum, height

Service-area Requirements:

- Overhead door should be located so that it is convenient to assembly area and construction-material storage.

- Access drive to overhead door required for material and project loading and unloading.
- Parking space should be adequate for bringing or removing projects or materials.

Safety Requirements:

- Safety precautions must be adequate for providing a safe environment for students and teacher.
- Approved fire extinguishers required in all areas of facility.
- Metal cabinets required for storage of flammable liquids.
- Approved self-closing metal containers required for storage of oily waste or rags.
- Fire blanket should be located in finish room.
- Exhaust system required to discharge fumes, smoke, and dust.
  Note: Overhead exhaust systems are recommended in all facility areas.
- Traffic lanes should be marked and left uncluttered.
- Approved respirators required for every student.
- Approved ear protection required for every student.
- Safety helmet required for every student.
- Overshoes or boots required for every student.
- Rubber gloves required for every student.
- A cabinet for safety glasses is required for sanitizing goggles and glasses.
- Lockable storage required for storage of hazardous materials.
- Safety glass required for doors, windows within 12 inches of doors, and window walls.
- Sprinkler and fire-detection systems required as specified by state fire codes.
- First-aid kit should be located for easy access in emergencies.

Hand Tools and Equipment

A well-equipped Concrete Masonry program should have all of the following tools and equipment for general laboratory/shop work. They should be readily available and in sufficient quantity to provide quality instruction.

The following are required beginning basic tools and may change and expand to keep pace with changing technology, industry, and curriculum.

Form-setting Tools (Standard Tool Kit)
Toolbox or tool bag
Claw hammer
Sledgehammer
Cross-cut saw
Hacksaw
Half hatchet
Magnetic nail driver
Side-cutting pliers
Adjustable wrench

Folding rule, 6’
Steel tape, 12’ to 16’
Steel tape, 100’
Dry line (stringline)
Chalk box and reel
Framing square
Combination square
Spirit level, 24” to 48”
Torpedo level
Pencil and keel
Finishing Tools (Standard Tool Kit)
Tool bag
Trowel, 12” x 3”
Trowel, 12” x 4”
Trowel, 14” x 4”
Margin trowel, 5” x 2”
Magnesium float, 16” x 3½”
Wood float, 18” x 3½”
Rubber (or cork) float, 8” x 4”
Jointer (groover), 6” x 4½” (with I” bit)
Edger, 6”x 2½” (with 3/8” radius)
Edger, 6” x 3½” (with 3/8” radius)
Edger, 6” x 4” (with ½” radius)
Masonry (or scaling) hammer
Chisel, ¾” x ¾” bit
Chisel. 10” x 1 7/8” bit
File, 12” or 14”
Rubbing brick, 8” x 3½” x ¾”
Knee pads
Knee boards
Work gloves
Miscellaneous Tools
Mortar hoe, heavy-duty
Pick (or mattock)
Single-bit axe
Compressed-air sprayer
Caulking gun, cartridge-type
Screed (straightedge), 4’ to 16’
Paver’s straightedge, 10’ to 12’
Magnesium bull float, 42” x 8” (with six sections of 6” fiberglass handles)
Fresno trowel (with handles), 24” to 30”
Wood darby, 30”
Wood darby, 48”
Magnesium darby, 30”

Jitterbug tamper, 36” or 46”
Jointer
Lathe
Molder
Miter box
Concrete rake, come-along, or placer with handle
Nylon texture broom, 18” to 36”, long-handled
Wire texture broom, 36”, long handled
Exposed-aggregate broom
Floor squeegee, rubber
Water hose, 50” lengths with regular and fogging nozzles
Bucket, 3 gallon
Bucket, 5 gallon
Extension cord, heavy-duty
Mud and epoxy mixer blades
Safety belt and harness
Twist-drill bits
Masonry bits
Speed-bore bits
Mortar box
Wood clamps
Stair gauge (angle)
Plane
Mallet
Framing square
Ladder

Power Tools and Equipment

Bench-top tilt-arbor saw, 10”
Concrete saw, 6 horsepower or larger
Radial-arm saw, 3 horsepower or larger
Portable circular saw, electric, heavy-duty, 7¼” to 8”
Jigsaw
Band saw
Saber saw
Scroll (stroke) saw
Disc sander
Belt sander
Combination disc/belt sander
Portable disc sander
Portable belt sander
Oscillating spindle sander
Sander/grinder, heavy-duty, 2.25 horsepower or larger
Portable hand-held vibrator/sander
Hand-held hammer drill, electric, 3/8”

Hand-held drill moor, electric, 3/8”
Hand-held drill motor, electric, ½”
Utility drill
Rock drill
Grinder, heavy-duty, ½ horsepower or larger
Concrete grinder, flexible-shaft, electric-engine or 3 horsepower, 4-cycle, air-cooled gasoline engine
Hand-held planer
Thickness planer (surfacer)
Mortiser
Router
Portable router
Press
Shaper
Stapler/tacker
Rotary hammer, heavy-duty, 2½” kit
Screw gun, electric
Trowel (with float and trowel blades), 36”
Trowel (with float and trowel blades, 42”
Tilting concrete mixer, 6-cubic foot capacity or larger
Screed
Vibrator, electric-engine or air-cooled gasoline-engine
Paving breaker
Demolition tool
Generator, air-cooled gasoline engine
Sprayer, electric
Wet/dry vacuum cleaner

Supplies

Form Materials:
2x4s, 8’ 10’, 12’ and 16‘
2x6s, 12’ and 16’
2x8s, 12’
2x10s, 12’
1x4s (for braces and stakes) 16’
Plywood, 4” x 8”, ¾” BB, class I and II
DFPA
Expansion Materials:
½” x 4” x 5’
½” x 6” x 5’
½” x 8” x 5’
Concrete Ingredients:
Portland cement

Masonry sand
Pea gravel (aggregate), ¼” or less
Coarse aggregate, ¾”
Crushed stone
Reinforcing Steel:
Welding-wire fabric, 6 x 6 W2.4 x W1.4 rolls
Reinforcing rods, 3/8” (0.375)
Reinforcing rods, 5/8” (.0625)
Surveying Equipment
Transit
Combination level/transit
Builder’s level
Tripod
Leveling rod
Plumb bob

Electrical Trades
Residential Electrical Wiring

Facility

AGC recommended Electrical Technology facilities to accommodatre16-20 students.

Type/Use of Area	Recommended Square Footage
Laboratory	5000
Tool Crib	200
Storage Room	500
Classroom/Instruction	700*
Teacher Office/Conference	150
Clean-up/Locker Room	200

* State requirement Chapter 61 School Districts § CC. Commissioner's Rules Concerning School Facilities.

Other Space Considerations:

- Electrical Trades/Residential Electrical Wiring laboratory should be located near the welding area to share a common fabrication space.
- Office and classroom should have glass walls facing laboratory area to facilitate supervision.
- Doors and entryways should facilitate use of wall space.
- Space around power equipment and work areas should allow for adequate traffic flow.

Climate-control Considerations:

- Laboratory should be heated to maintain room temperature at 68 degrees during winter months.
- Classroom and teacher's office should be heated and air-conditioned to maintain room temperature at an acceptable level to enhance learning.

Noise-control Considerations:

- The electrical technology laboratory is a medium noise-level areas and the design and location of the laboratory should facilitate keeping noise levels at or below the medium level.

Illumination Considerations:

- General task lighting should be maintained at 50 to 70 foot-candles at the working surface.

Plumbing Considerations:

- Water Plumbing required in the following areas:
  Restroom and dressing areas require both hot-and cold-water plumbing.
  Water fountain requires cold-water plumbing.
  Wash basin in clean-up area requires both hot- and cold-water plumbing.

Eyewash area in lab requires cold-water plumbing.
- Drain located in laboratory area.

- 100 psi compressed-air plumbing required in laboratory area.

Communications Requirements:
- Telephone located in the teacher's office, signal must be audible in the laboratory.
- Intercom located in teacher's office and in laboratory.
- Clock located in laboratory and classroom.

Electrical Requirements:
- Regular wall outlets, 110-volt on 8' centers, located 42" above floor level.
- Special outlets required include: 120-volt and 240-volt, 100-amp; 277-volt and 480 volt, 200-amp, with transformer capacity for any construction.
  Note: Other heavy power requirements should be determined after approval of equipment lists.
- Keyed master-switch shutoff switch, panic button, GFCI-protected 110-volt.

Security Requirements:
- Security locks required in storage room provided with supplies and in tool crib, where tools and test equipment will be stored.

Window, door, and floor Requirements:
- Windows on outside walls must be located a minimum of 72 inches above floor level.
- Window or glass walls on inside partitions must be placed a maximum of 42 inches above floor level.
- Sliding mesh window and counter required in tool crib.
- All interior doors must be arranged for safe and efficient traffic flow when door is open.
- Service door, 10' x 10', is required in laboratory.
- Personnel door should be located adjacent to the service door.
  Note: All personnel doors should be 48".
- Laboratory floors are required to be sealed, hardened concrete.

Aesthetic requirements:
- Walls should have a 6-foot wainscot of glazed brick, tile, epoxy paint, or semi-gloss enamel.
- Ceilings should be painted a light neutral color.
- Super-graphics may be used to identify various facility areas.
- Ceilings should adhere to 12' minimum height.

Service-area Requirements:
- Overhead door should be located so that it is convenient to assembly area and construction-tool storage.

- Access drive to overhead door required for material and project loading and unloading.
- Parking space should be adequate for bringing or removing projects or materials.

Safety Requirements:

- Safety precautions must be adequate for providing a safe environment for students and teacher.
- Approved fire extinguishers required in all areas of facility.
- Metal cabinets required for storage of flammable liquids.
- Approved self-closing metal containers required for storage of oily waste or rags.
- Exhaust system required to discharge fumes, smoke, and dust.
  Note: An explosion-proof system is required in the finish area.
- Traffic lanes should be marked and left uncluttered.
- Approved goggles or glasses required for every student.
- A cabinet for safety glasses is required for sanitizing goggles and glasses.
- Lockable storage required for storage of hazardous materials.
- Safety glass required for doors, windows within 12 inches of doors, and window walls.
- Sprinkler and fire-detection systems required as specified by state fire codes.
- First-aid cabinet should be located for easy access in emergencies.
  Note: The first-aid cabinet should be accessible only to teacher.
- Outside and inside facility warning signs for people wearing contact lenses that electrical arcs will immediately dry out surface of the eyes and fuse contact lens to eye surface.

Tools and Equipment

A well-equipped Electrical Technology program should have all of the following tools and equipment for general laboratory/shop work. They should be readily available and in sufficient quantity to provide quality instruction.

The following are required beginning basic tools and may change and expand to keep pace with changing technology, industry, and curriculum.

Training Equipment and Instrumentation
Student wiring boards
DC ammeter, 0-3-30 amps
DC voltmeter, 0-1.5-15-150-volt,
AC voltmeter. 0-2.5-25-250-volt
Universal galvanometer
Reference standard meter, DC amp-1/2%
Reference standard meter, AC amp-1/2%
Demonstration meter, 1 movement, 10-½" scale, c/w interchangeable scales, 2 DCA, 2 DCV, 1 ACA, 1 ACV, 1 Galvo, 1 ohm
Demonstration meter, DC voltmeter, ranges 0-15-150-volt
Meter movement demonstrator, AC ammeter, ranges 0-1-5-amp, moving vane
Meter movement demonstrator, Wattmeter, ranges 0-750-1500
Portable wattmeter, single-phase, 0.5-2.5-amp, 60/120-volt, AC
Insulation tester
Stop watch
Lab Equipment
Drill, ¼" and ½"
Drill-bit set, ½" x 1/16"
Drill press, 15", hand-fed
Bench grinder, 6"
Planer, 13" x 6"
Jointer, 6"
Radial-arm saw, 10"
Table saw, 10"
Saber saw, heavy-duty
Skill saw, 7"
Reciprocating saw, electric
Power miter saw
Power router kit, heavy-duty
Belt sander, heavy-duty, 4" x 24"
Steel tape, 100'
Claw hammers, 13 oz .and 6 oz.
Hammer, #4
Hand brace, heavy-duty
Wood bit set, ¼" through 1"

Expansion bit, 7/8” through 3” hole
Aluminum levels, 24” and 48”
Builder’s level
Steel framing square, rafter-table
Combination square
Aluminum walk boards
Pipe wrench, 14”
Wrench, adjustable, open-end, 12
Pliers, slip-joint and plug-nose
Dresser, diamond-point
Pipe vise
Soldering gun, heavy-duty
Flaring set
Rubber mallet
Propane torch
Compressed-air nailing gun
Punch and chisel set
Airless paint rig
Safety glasses or goggles

Electrician’s Basic Tool Kit

Tool pouch and belt
Hard hat
Safety glasses
Wrenches, 8” adjustable and 16” pipe
Allen wrench set, large
Drill, electric, ½”,
Drill, ¾”- or 1”, ship auger
Drill, hand brace
Pliers, 10” slip-joint, diagonal, lineman’s and needle-nosed
Screwdrivers, 4”, 6”, 8”, and 12” Standard (flat-blade), plastic-handled
Screwdrivers, 4” and 6” Phillips, #1 and #2 point
Screwdrivers, Kline, 3/16”, ¼”, and 5/16” blades
Awl, metal
Pipe bender, ½” and ¾”
Portable band saw
Bolt cutter, small
Chisel, wood
Crimper, terminal
Hacksaw
Hammer, straight-claw
Hole-saw set
Knife, electrician’s
File, rat-tail, 3-corner, flat
Nut driver

Puller, fuse
Wire strippers
Rule, folding
Tape measure
Multimeter, volt/ohm/amp

Supplies

Abrasives:
Aluminum-oxide cloth, 100- and 240-grit sheets
Emery cloth, coarse (#12 to #24), sheet-type
Emery cloth, medium (#30 to #60) sheet-type
Emery cloth, fine (#70 to #120) sheet-type
Adhesives:
Electrical tape
Masking tape
Plastic cement
Cutting:
Blades, hacksaw, 18-teeth and 24-teeth
Cutting oil
Lighting devices:
Ballast, Fluorescent, 40-watt, 115-volt
Bulb, Incandescent lamp, 40-, 60-, 100-, and 150-watt, 155-volt
Lamp, Fluorescent, 40-watt, 48" x 1 ½" bipin preheat-type
Lamp, Fluorescent, 40-watt, 48" x 1½", bipin rapid start
Lamp, Infrared, 250-watt, 120-volt, medium base
Spot lamp, Incandescent, 150-watt, 115-volt
H. I. D. lighting
Fixtures:
Bases, lamp, medium
Bases, lamp, miniature-screw type
Boxes, conduit, ½" size, 4" x 2 1/8"
Boxes, outlet, ½", ¾", 1" K.O.
Boxes, receptacle, single duplex
Boxes, switch, 2 1/8" x 4", ½", ¾", and 1" K.O.
Receptacles, duplex and single
Electrical Control:
Circuit breakers, various sizes
Fuses, cartridge, renewable-type, 15-, 20-, 30-, 40- and 55-amp
Fuses, plug, 5-, 25-, 20-, and 30- amp
Starters, fluorescent, to-watt, 115-volt, reset
Starters, fluorescent, 40-watt, 155-volt, standard

Switches, single-pole, T-rated, 10-amp, 125-volt
Switches, 3-way, T-rated, 10-amp, 125-volt
Switches, 4-way, T-rated, 5-amp, 125-volt
Fittings:
Conduit, EMT, ½", ¾", and 1'
Conduit, Flexible-steel, ½", ¾" and 1"
Conduit, Rigid ½", ¾" and 2" galvanized
Conduit, PVC, ½", ¾", 1" and up to 3"
Conduit, ENT, ½"and ¾"
Connectors, B-X cable, ½"
Connectors, EMT, ½", ¾" and 1" set-screw-type
Connectors, EMT, ½", ¾" and 1" 2-piece steel
Connectors, Flexible-steel, ½", ¾" and 1" squeeze-type
Connectors, Split-bolt, assorted
Connectors, ENT
Couplings, EMT, ½" ¾" compression-type
Couplings, EMT, ½", ¾" and 1" indenter-type
Couplings, ENT
Insulators, EMT, ½", ¾" and 1" insulated-throat, compression-type
Steel straps, EMT ½", ¾" and 1", one-hole type
Soldering
Acid swab
Flux, non-corrosive-paste type
Muriatic acid
Sal ammoniac
Solder, Acid-core, 50/50 and 60/40
Solder, Rosin-core, 50/50 and 60/40
Wire
Cable, entrance, #6
Masking tape, 1" and 1½"
Plastic tape, ½", 1", and 1½"
Wire, single conductor, #12 and #10 Thhn, black
Wire, #3, #3/0, and #2/0 Thhn
Wing nuts, 451, 452, 453
Cable, NM 12/2-, 12/3- 10/2-, 10/3-, 8/2- 8/3- and 6/2 w/gr

Heating, Ventilation, Air Conditioning, and Refrigeration

Facility

AGC recommended Heating/Air Conditioning facilities for 16-20 students:

Type/Use of Area	Recommended Square Footage
Laboratory	4700
Tool Room	300
Storage, materials and supplies	400
Clean-up/Locker Room	300
Classroom/Instruction	700*
Teacher Office/Conference	150

* State requirement Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities.

Other Space Considerations:

- Office and classroom should have glass walls facing laboratory area to facilitate supervision.
- Doors and entryways should facilitate use of wall space.
- Space around power equipment and work areas should allow for adequate traffic flow.

Climate-control Considerations:

- Classroom and laboratory should be provided with heat and air conditioning systems to keep temperatures at an acceptable level to enhance learning.
- Refrigerated cooling is recommended with rust-prevention maintenance required on machines and tools.

Noise-control Consideration:

- Equipment with a high-operational noise level should be located in secure area outside the laboratory.
- Large industrial equipment should meet OSHA noise-level regulations and be installed following manufacturers' recommendations.

Illumination Considerations:

- Lighting must be adequate to meet requirements of both daytime and nighttime uses of laboratory, classroom, and storage areas.
- Natural lighting (skylights) should be used to provide energy-efficient illumination whenever possible.
- Artificial lighting must not affect coloration determination.

Plumbing Considerations:

- Water plumbing as follows:
  Outlets on each wall in laboratory require both hot- and cold-water plumbing.

Manifold with plugged-tee fittings every 3' requires cold-water plumbing running entire length of commercial equipment.
Freeze-proof hose bibs located in outside storage area require cold-water plumbing.

- Compressed-air plumbing as follows:
  Laboratory requires a minimum of three (3) locations on each wall.
  Outside laboratory requires an air station with hose storage adjacent to outside regulator.
  Each student workstation requires low-pressure air that is filtered and dried before distribution.
- Drains as follows:
  Commercial equipment area requires 4" (minimum size) floor drains for every 100 square feet of floor space.
  Each student workstation requires a 2" plugged drain to be used only as condensate drain
- Natural gas plumbing as follows:
  Laboratory requires outlets on each wall.
  Outside storage area requires stud-outs to facilitate installation of gas-fired refrigeration unit.

Communications Requirements:

- Telephone located in the teacher's office; remote signaling device should be located in laboratory and storage areas.
- Intercom/paging system should be located in teacher's office, laboratory and storage room.
- Clock (72" diameter, set and synchronized centrally) located in laboratory and classroom.
- Intrusion, fire, and high water alarm system should be located in teacher's office, classroom, and laboratory.

Electrical Requirements:

- Outlets required in laboratory:
  240-volt, single-phase outlet with grounded neutral conductor
  220- and 240-volt, three phase
  120-volt
  208-volt
- Each student workstation requires a 240-volt single-phase outlet and a 120-volt outlet.
- Commercial-equipment area requires a 200-amp, 240-volt, three-phase breaker panel.
- Each piece of heavy-current draw equipment requires additional disconnect panel.
- Teacher's office requires a minimum of two panic electrical-system switches on all four walls.

Security Requirements:

- Security locks required on laboratory storage, and teacher's office.

- Keyed locks required on door from classroom to laboratory to allow use of classroom without access to other facility areas.
- Burglar-alarm system recommended throughout facility.

Windows Doors, Floor, Wall, and Ceiling Requirements:

- Windows should be provided in classroom, laboratory, and office areas.
- High windows and skylights are recommended in the laboratory.
- Windows are not recommended in storage areas that require high security
- Windows in the classroom should be shaded to allow for effective viewing of audiovisual presentations.
- Double doors with a minimum of 6' of open access required in the laboratory.
- A-grade, level 10' x 10' overhead open access recommended in laboratory.
- Sealed concrete floors recommended in laboratory.
- Tile floors recommended in classroom and teacher's office.
- Concrete floors preferred in outside storage and work areas.
- Walls in classroom and laboratory should have a 6' wainscot of washable, high-impact resistant epoxy-based paint.
- Suspended-panel ceiling with recessed lighting and climate-control venting required in classroom and tool-storage area.
- Ceiling height in classroom should facilitate use of overhead projection system.
- Ceiling height in laboratory should facilitate ductwork and service drops to student workstations.

Safety Requirements:

- Safety glass required on doors, windows within 12" of doors, and windows walls.
- Sprinkler and fire-detection systems required as specified by start fire codes.
- Exhaust system required above arc-welding area and oil-fired trainer area.
- Ductwork to the outside required at each gas-fired furnace.
- A minimum of 48" wide lanes for material transport is required around student workstations.
- Safety aisles required around each piece of laboratory equipment.

Hand Tools and Equipment

A well-equipped Heating/Ventilation/Air Conditioning/Refrigeration program should have all of the following tools and equipment for general laboratory/shop work. They should be readily available and in sufficient quantity to provide quality instruction.

The following are required beginning basic tools and may change and expand to keep pace with changing technology, industry, and curriculum.

Drill motor, variable speed, reversible
Drill bits set, 1/64" to 3/8"
Hacksaw and blades
Soldering gun, 200-325 watt
Tape, 12'
Ace-Oxg welding set, portable
Halide torch
Flaring tool and swaging set, ¼" to 5/8"
Junior tube cutter
Tubing cutter, 1/8" to 1 1/8"
Gauge manifold set complete with 36" charging hoses
Fin combs, complete set
Heat gun, 500-degree to 700-degree range
Pinch-off Tool
Pocket thermometer, 20 to 180 degrees F.
Pair of scales, up to 250 pounds
Simpson 260-6P meter
Amprobe, RS-3
Amprobe voltprobe VT-124, 24-volt to 600-volt
Vacuum pump, 3 cubic inch
Silver solder, 3 T.O., 45%
Stay silver, 1 pound, #15 brazing rod
Stay flux
Plumber abrasive
Leak lock
Set of 9 screwdrivers
Starting screwdriver
Plum level, 6"
Set of combination box end and open end wrenches ¼" through 1 /1/8"
Pitman arm separator
Set of Allen wrenches, short
Set of Allen wrenches, long
Ratchet wrench, ¼"
Set of valve stem sockets
Adjustable wrenches, 4", 6", 8", 10" 12"
Pliers, vice grip, 7"
Pliers, common, 7"

Pliers, side cutters, channel lock, and lineman
Oil can
Flashlight
Mirror
Tape, duct, plastic, friction
Refrigerant oil, 150 and 300
Hand cleaner
Copper, ¼” 3/8”, ½”, and 5/8”
Flare nuts and fitting, assortment
R-12, 30-pound cylinder
R-22, 25-pound cylinder
R-11, 25-pound cylinder
R-502, 25-pound cylinder
Millivolt meter
Tube benders, ¼”, ”3/8”, ½”, and 5/8”
Tin snips, left-handed and right-handed
Offset screwdriver, slotted and Phillips
Screwdrivers, set, 3/16”, ¼”, 5/16” 11/32” 3/8”
Extension cord, 25’ and 50’
Trouble light
Solder, rosin core and 95.5
Service bed on pickup
Hard start kit, 115-volt and 230-volt
Acid tester
Temperature recorder, 20 degrees to 200 degrees
Wire connectors, assortment
Roll of 5 wire control wire
Test light screwdriver
Liquid line driers, assortment
Seal tight Greenfield and connectors, ½” and ¾”
Solid wire, #10, #12, #14, #8
Sweat fittings, copper assortment of popular sizes
Clipboard
Drive socket sets, ¼”, 3/8”, ½”
Pipe wrenches, 6”, 12”, 14”, 18”, 24”
Wrench, 15” adjustable
Fox tail brush
Drop cloths
Hand rags, ample supple

Piping Trades/Plumbing

Facility

AGC recommended Plumbing facilities for 16-20 students:

Type/Use of Area	Recommended Square Footage
Laboratory	3000
Outdoor Construction Area	3000
Secured Outdoor Storage Area	1000
Tool Crib	250
Storage Room	500
Clean-up/Locker Room	300
Classroom/Instruction	700*
Teacher's Office/Conference	150

* State requirement Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities.

Other Space Considerations:

- Laboratory design should facilitate supervision; blind spots should be avoided.
- Office and classroom should have glass walls facing laboratory area.
- Doors and entryways should facilitate use of wall space.
- Laboratory space should be sufficient to accommodate skills practice.
- Classroom design should facilitate effective use of media equipment.

Climate-control Considerations:

- Classroom and teacher's office should be provided with both heating and air conditioning adequate to maintain room temperature at an acceptable level to enhance learning.
- Laboratory should be heated to maintain room temperature at 68 degrees in the winter months.

Noise-control Considerations:

- Classroom should be isolated from laboratory by location, insulation, or other sound proofing means.
  Note: The plumbing lab is a high-noise level area and should be isolated as much as possible from parts of the facility where a quieter environment is required.
- Equipment-noise level should conform to OSHA noise-level regulations.

Illumination Considerations:

- The recommended lighting level is 50 to 70 foot-candles at working surface.

Plumbing Considerations:

- Water plumbing required in the following areas:
  Service sink requires both hot- and cold-water plumbing.
  Half-round basin in clean-up area requires both hot- and cold-water plumbing.

Hose bibb near overhead door and in mock-up area requires cold-water plumbing.
Classroom requires cold-water plumbing.
Water fountain requires cold-water plumbing.

- Compressed-air plumbing is laboratory requires four outlets regulated from 0 psi to 120 psi.
- Drains throughout laboratory require 3" minimum diameter.

Communication Requirements:

- Telephone located in teacher's office; signal must be audible when machines are in use.
- Intercom located in laboratory and in classroom.
- Clock located in laboratory and classroom.
- Bell/alarm system located in classroom and in laboratory; sound must be audible when machines are in use.

Walls, Doors, Floor, and Ceiling Requirements:

- Walls should be painted with a flat, low-gloss enamel and have a 6' wainscot of high-impact epoxy.
- Arrange all interior doors for safe and efficient traffic flow when door is open.
- Service door, a 10' x 12' overhead door, is required in laboratory area.
- Personnel door should be located adjacent to service door.
  Note: All personnel doors should be 48".
- All ceilings should adhere to a minimum-height requirement of 12'.
- Floors should be sealed, hardened concrete.

Service-area Requirements:

- Overhead door should be located so that it is convenient to assembly area and construction-tool storage.
- Access drive to overhead door required for material and project loading and unloading.
- Access drive should be adequate to allow for easy maneuverability of heavy equipment.
- Parking space should be adequate for bringing or removing projects or materials.

Safety Requirements:

- Safety precautions must be adequate for providing a safe environment for trainees and teacher.
- Approved fire extinguishers required in all areas of facility.
- Metal cabinets required for storage of flammable liquids.
- Approved self-closing metal containers required for storage of oily waste or rags.
- Exhaust system required discharge fumes and dust.
- Overhead exhaust systems recommended in all facility areas.
- Approved goggles or safety glasses required for every student.

- A cabinet for goggles or safety glasses is required for sanitizing goggles and safety glasses.
- Lockable storage is required for storage of hazardous materials.
- Safety glass required for doors, windows within 12” of doors, and window walls.
- Sprinkler and fire-detection systems required as specified by state fire codes.

Power Tool and Equipment

The following are required beginning basic tools and may change and expand to keep pace with changing technology, industry, and curriculum.

Arc-welding unit, 180-amp, 50-cycle stick welder with accessory kit
Acetylene welding unit, Smith SS315 (complete)
Oxyacetylene torch
Propane torch (#LP-99)
K1 turbo torch kit and tank
Cylinder truck
Welding curtains with 4.4.4 wings
Hot-air torch
Bench grinder, 7", ½ horsepower, complete with stones
Grinders, pedestal and portable
Face shield
Rotary hammer drill
Drill, ½", heavy-duty, electric
Drill-bit set
Expansive bits, 7/8" to 3"
Ladle, 4"
Pipe die set, 1/8" to 2"
Pipe machine
Flaring and swaging set
Asbestos lead joint runners
Power saw, super-duty, 7 ½"
Reamer unit
Soldering gun
Personnel hoist or lift
Pipe taps
Pipe-threading dies
Pipe vise
Air compressor and attachments
Test pump
Test equipment
Mercury gauge (gas-testing)
Melting furnace
LP 253 bench base
LP 852 furnace with hood
LP 912, #29 cylinder
LP 3028 hose, 12"
Lead pots, 8"
Post-hole digger/boom/backhoe/bucket/blade
Ratchet level hoist, 3-ton
Power machine
Sewer machine

Rodding equipment
Handlebar (walk-behind) trencher
Backhoe
Closet auger
Pipe reamer
3-way pipe threader
Pipe cutter
Wheel-strand unit for pipe master
Reamer for pipe master (slide-in)
Band saw
Porta-band
Nipple chucks
Portable generator
Portable chop saw
Space heater
Heat fusion tool (for PE-gas piping)
Polybutylene-pipe crimping tool
T-handle torque
Caulking and packing irons
Chain-pipe tong
Chain vise
Dividers or trammels
Surveying Equipment
Transit
Tripod
Plumb bob

Hand Tools and Equipment

Wrenches: assorted sizes, 3/8” to 1¼”, combination box- to open-end
Wrench set, offset hex
Tub socket wrench
Strap wrench
Pipe wrenches, straight, 12”, 14”, 24”, and 36”
Pipe wrench, offset, 14”
Crescent wrenches, 6”, 10”, 12”, and 16”
Specialty basin wrench
Chisels: ¾” and 1”, all-steel
Wood chisel set
Slip joint pliers: 10’, 12”, and16”, grooved-joint
Diagonal-cutting pliers, heavy-duty, 7”
Side-cutting pliers, 8”, crescent
Pliers, 3-way wire-cutting/slip-joint combination, 8”
Ball-peen hammers: 12 oz. and 16 oz.
Rip-claw hammer, 15 oz.

Slag hammer
Punches: ¼", 5/16", 3/8", ½", and 5/8"
Four-in-one screwdrivers: assorted sizes, regular and Phillips
Tubing cutters: 3/16" to 1 1/8" (#20)
Tubing cutters: 1/8" to1" (#10)
Tubing cutter, close-quarter, small
Pipe cutters
Soil pipe cutter, 2" to 6"
Saw, 26"
Hacksaw, adjustable, pistol-grip handle
Plumber's hole-saw kit
Reciprocating saws, all sizes
Plastic-cutting saw
Compass saw, 12" blade
Level, 24" aluminum
Spirit level
Steel tape, 12' and 100'
Rules, circumference and folding
Squares: framing, combination, and carpenter's
Tin snips, 10" and bulldog
Oil can, 7/8-pint capacity
Shovels, assorted sizes
Wheelbarrows
Mortar-mixer hoe, 2-hole
Auger
Scaffolds
Ladders
Sling and hoist
Putty knives
Files, assorted sizes
Chalk line
Pipe threader
Marking awl or scratch awl
Shears
Mattock
Plumber's wood-bit set
Tri-stand with vise
Bench vise, large
Seat dresser
Caulking iron
Packing tool
Clean-out, 3/8" x 50' and 1½" to 3'
Scriber
Vacuum plunger
Turnbuckles and clamps
Assorted fastenings

ELECTRONICS SYSTEMS

Electronics

Facility

Type/use of space	Recommended Square Footage
Laboratory	2000-2400
Classroom/Instruction	700*
Storage	300
Teacher Office/Conference	150
Clean-up/Restroom/Lockers – Boys	40-50
Clean-up/Restroom/Lockers– Girls	40-50

*State requirement Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities.

Special Considerations:

1. Work benches that accommodate computer-based instruction with storage for circuit boards and other materials.
2. Quadraplex outlets 6' on center on work benches along side walls
3. Room-darkening shades for use with LDCs.
4. Compressed air supply

Equipment List
Basic Electronics Core Curriculum

The following are required beginning basic tools and may change and expand to keep pace with changing technology, industry, and curriculum.

	DC Circuits	AC Circuits	Semiconductor Devices	Digital Fundamentals
Bench Equipment:				
Optimal: 1 station per student				
Acceptable: 1 station per 2 students				
Dual DC power supply	X	X	X	X
Function generator		X	X	X
Dual trace oscilloscope		X	X	X
10 X probes for oscilloscope 2 each		X	X	X
1 X probes for oscilloscope/signal generator		X	X	X
Leads for DC source, 2 sets	X	X	X	X
Digital Trainers				X
Logic probe				X
22-24 gauge, solid wire, several colors	X	X	X	X
Optional Equipment:				
LCR meter, 2 for program		X	X	
Hand Tools/ Equipment:				
Protoboard	X	X	X	X
Digital meter with leads	X	X	X	X
Clip leads, 14 " length, w/mini chips	X	X	X	X
Scientific calculator	X	X	X	X
Needle nose pliers, 3"and 4"	X	X	X	X
Screwdriver, 1/4" blade x 4" shaft	X	X	X	X
Screwdriver, Phillips #4	X	X	X	X
Wire strippers, size 22-30 gauge	X	X	X	X
Graph paper, 10/inch	X	X	X	X
Convenience Hand Tools:				
5 ' diagonal cutting pliers	X	X	X	X
Ruler, 12" with metric	X	X	X	X
Low wattage soldering iron w/ stand	X	X	X	X
Desoldering braid	X	X	X	X
Solder, ½ lb. Spool, 60% tin, 40% lead	X	X	X	X

Heat sink	X	X	X	X
Nutdriver set	X	X	X	X
Mini IC clip with leads	X	X	X	X
Personal Protection Equipment:				
Safety glasses, ANSI Z87.1-1989	X	X	X	X
(one pair per student required)				
Components: as recommended by lab manual				
Resistors, fixed and variable	X	X	X	X
Inductors		X	X	
Capacitors	X	X	X	
Transformers		X	X	
Diodes			X	
Transistors, NPN, PNP			X	
Digital chips				X
Operational amplifier IC chips			X	
LEDs, various colors		X	X	X
Seven segment displays				X

Computer Maintenance Technology

Facility

Type/use of space	Recommended Square Footage
Laboratory	2000-2400
Classroom/Instruction	700*
Storage	300
Teacher Office/Conference	150
Clean-up/Lockers	100

*State requirement Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities.

Equipment

The following are required beginning basic tools and may change and expand to keep pace with changing technology, industry, and curriculum.

Safety Glasses with side shield (to meet ANSI Standard Z87.1-1989)
Safety Glasses Cabinet with Ultraviolet lamp
Anti-static wrist strap, desk mats, and floor mats
Computer Maintenance Certification Equipment
Computer Maintenance Certification Reference Materials
Digital Multimeter (optional)
First Aid or CPR Course Certification (optional)
Hand Tools:
Phillips screwdrivers, #0, #1, #2
Flathead screwdrivers, ¼" , 3/8", 7/16"
Diagonal cut pliers, large and small
Slip joint pliers
Set of Torx® Drivers
Drill and bits
Set of Nutdrivers
Wire Cutters
Wire Crimper – Coaxial and RJ45 and 11
Non-Metallic Drivers
Soldering pencil, 25W (optional)
Desoldering Wick (optional)
Desoldering Pump (optional)
Solder 60/40 Rosin Core (optional)
Jacob's Ladder
Micro2000 (optional)
Pocket Post (optional)
Pocket PC Reference
Van-De-Graaf Generator (optional) Ion field generator can be obtained from a physics class

Industrial and Manufacturing Systems

No specific program facility standards or recommendations available for the courses in the Industrial and Manufacturing Systems.

Metal Technology Systems

The Associated General Contractors of America (AGC) provides the following guidelines for to assist in the planning and implementation of all Construction-Craft programs.

Facility Types. The types of facilities required for a training program will depend upon the type of training and on the number of students to in training. The training facilities must be accessible to the population being served and should include a classroom, laboratory, tool and material storage area, and an office for the instructor(s). Facilities should provide a large enough space for special skill projects. Facilities should have adequate lighting and air circulation; the office and classroom should have sufficient hear and air conditioning to maintain an environment conducive to working and learning. The entire facility should be organized with security in mind. To the extent possible, the facility should provide an environment as similar as possible as that found on the job site.

Facility Space and Equipment. Facility space and equipment must effectively accommodate the number of students to be included in the program, the instructor's, and any required support staff. Facilities and equipment inventory must reflect stated program training goals and objectives. Duplication of essential tools and equipment is necessary so that all students will have ready access to them at all times.

Safety Provisions. Adequate provision must be made for the safety of the students and the instructional staff.

Laboratories. It is crucial that laboratories for construction-craft programs are designed to simulate the industrial setting. The equipment must duplicate that used in the industry, and the training conducted on live or simulated projects as much as possible. Future expansion and adaptability of the programs must also be considered in the planning/design phase. The size of the laboratories will depend on the program and on the training objectives of the program. Careful planning will permit maximum usage of the laboratory. Most trade and industrial programs require as much wall space as possible. Wasted wall and floor space are as expensive as usable space.

Instructor's Office. AGC recommends that each instructor have office space available. Office space should not be part of the laboratory or the classroom. It is best if one wall of the office adjoins the laboratory area and that the adjoining wall be glass so that the instructor can observe activities within the laboratory while in the office.

Classroom. AGC recommends that the classroom be separate from the laboratory but adjacent to it to permit ease of demonstrations with equipment and to require a minimum of students' time in travel from the classroom to the laboratory.

Personal Facilities. Personal facilities such as restrooms, locker area, and washrooms are a vital part of the total program facility. AGC recommends that personal facilities be close to the laboratory area to allow instructor supervision and help to eliminate possible discipline problems. Large wash fountains that will accommodate up to six people are normally preferred, and it is advisable to locate wash-up areas within the laboratory itself.

Facilities for Students with Disabilities. It is important to keep in mind the needs of students with disabilities in order to make the facilities as accessible and usable for these students as possible. Each program will need to purchase, adapt, or modify any equipment needed for students with disabilities.

Lighting. The lighting should be planned to substantially reduce the energy consumed by the lighting system while still providing students with the quality and quantity of illumination required to perform their tasks. Effective lighting must be achieved in a manner consistent with student and program requirements, such as productivity and visual comfort; aesthetics, and federal, state, and local codes and ordinances. AGC recommends the illumination Engineering Society's *IES Lighting Handbook* as the most appropriate resource to determine lighting for trade and industrial programs.

Teaching Aids and Equipment. The training program must be equipped with appropriate teaching aids, audiovisual equipment, and electronic equipment. The quantity of this type of equipment depends on the number of students.

Sheet Metal

Facility

AGC recommended Sheet Metal facility for 15-20 students:

Type/Use of Area	Recommended Square Footage
Laboratory	3600
Fabrication area	1200
Drafting area	100
Welding area	100
Storage, secured	300
Storage, materials and tool room	200
Classroom/Instruction	700*
Teacher's Office/Conference	150
Clean-up/Locker-room	150

* State requirement, Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities

Other Space Considerations:

- Sheet metal laboratory should be located near the welding area to share a common fabrication space.
- Office and classroom should have glass walls facing laboratory area to facilitate supervision.
- Doors and entryways should facilitate use of wall space.
- Space around power equipment and work areas should allow for adequate traffic flow.

Climate-control Considerations:

- Ventilation in laboratory should comply with OSHA standards for machine, foundry, welding, soldering, and finish areas of rooms.
- Classroom temperature should be kept at an acceptable level to enhance learning.
- Recommended temperature in laboratory is 68 degrees.

Noise-control Considerations:

- Classroom should be isolated from laboratory by location, insulation, or other sound proofing means.
- Equipment-noise levels should conform to OSHA noise-level regulations.

Vibration-control Considerations:

- Floor-mounted and wall-mounted machines should be equipped with vibration-dampening devices.

Illumination Considerations in finish area:

- Explosion-proof light fixtures are required.

- Recommended lighting level is 150 foot-candles at 30 inches off floor.
- Lighting should show true color to allow for correct color determination.

Plumbing Considerations:

- Water plumbing required in the following areas:
  Finish room requires cold-water plumbing.
  Water fountain requires cold-water plumbing.
  Half-round washbasin in clean-up area requires both hot- and cold-water plumbing.
- Drains
  Floor drain required in finish area.
  4" drain required in basin in clean-up area.
- Gas plumbing should be provided for the following:
  Soldering furnace
  Furnace
  Forge
  Heat-treating furnace
- Compressed-air plumbing:
  All outlets regulated to 125 psi.
  Note: Airflow must be regulated so as not to exceed accepted standard for job at hand.
  Spray-finish outlet regulated to 50 psi and equipped with a water separator.
  6 outlets for impact-tool operation regulated to 100 psi and equipped with a water separator and oil.

Communications Requirements:

- Telephone located in the instructor's office, signal must be audible in the laboratory.
- Intercom located in instructor's office and in laboratory.
- Clock located in laboratory and classroom.

Electrical Requirements:

- Outlets, 120-volt outlets on 10-foot centers, located 36 inches above floor level.
  Note: If three-phase outlets are not used, 120-and 240-volt outlets are not required.
- Motors must be over ½ horsepower, 240-volt, three-phase or 208-volt.
- Recommended electrical systems:
  Overhead bus bars, most flexible, 120- and 240-volt.
  Overhead conduit with drops, acceptable, 120- and 240-volt
- Master switch shutdown should provide easy access for emergencies.
  Note: There should be a minimum of two panic buttons in the emergency shutdown system.
- Means of locking off power completely.

Security Requirements:

- Security locks required in laboratory, material storage area, supply room, and instructor's office.
- Burglar alarm system required throughout facility.

Window, Door, and Floor Requirements:

- Windows on outside walls must be located a minimum of 72 inches above floor level.
- Window or glass walls on inside partitions must be placed a maximum of 42 inches above floor level.
- Sliding mesh window and counter required in tool crib.
- Arrange all interior doors for safe and efficient traffic flow when door is open.
- Service door, 10' x 12', is required in laboratory.
- Personnel door should be located adjacent to the service door.
  Note: All personnel doors should be 48".
- Laboratory floors should be sealed, hardened concrete.

Aesthetic requirements:

- Walls should have a 6' wainscot of glazed brick, tile, epoxy paint, or semi-gloss enamel.
- Ceilings should reflect light and absorb sound.
- Ceilings should adhere to 12' minimum height guideline.

Service-area Requirements:

- Overhead door should be located so that it is convenient to assembly area and construction-tool storage.
- Access drive to overhead door required for material and project loading and unloading.
- Parking space should be adequate for bringing or removing projects or materials.

Safety Requirements:

- Safety precautions must be adequate for providing a safe environment for students and instructor.
- Approved fire extinguishers required in all areas of facility.
  Note: Avoid water extinguishers as they are unsuitable for use on electrical fires.
- Metal cabinets required for storage of flammable liquids.
- Approved self-closing metal containers required for storage of oily waste or rags.
- Fire blanket should be located in finish room.
- OSHA-approved manifold system required in laboratory.
- Exhaust system required to discharge fumes, smoke, and dust.
  Note: An explosion-proof system is required in the finish area.
- Acetylene and oxygen bottle must be secured to a wall or rack.
  Note: Acetylene bottles must be stored at least 20 feet from oxygen bottles and both types of bottles should be stored outside behind a divider wall.
- Overhead exhaust systems recommended in all facility areas.
- Traffic lanes should be marked and left uncluttered.
- A cabinet for safety glasses is required for sanitizing goggles and glasses.
- Lockable storage required for storage of hazardous materials.
- Safety glass required for doors, windows within 12 inches of doors, and window walls.
- Sprinkler and fire-detection systems required as specified by state fire codes.
- Eyewash area required in laboratory.

Power Tools and Equipment

A well-equipped Sheet Metal program should have all of the following tools and equipment for general laboratory/shop work. They should be readily available and in sufficient quantity to provide quality instruction.

The following are required beginning basic tools and may change and expand to keep pace with changing technology, industry, and curriculum.

Surface grinder, 24", 3-horsepower, 240-vold, 3-phase
Pedestal grinder, 7", ½ horsepower, 120-vold
Pedestal grinder, 19", 1½ horsepower, 240-volt, 3-phase
Band saw, 14", ½ horsepower, 120-volt
Band saw, 20", 1 horsepower, 120-volt, 3-phase
Band saw, horizontal, 7" x 10", ½ horsepower, 120-volt
Cornice break, 36"
Break, 10", 16-gauge
Press break, 8', ¼"
Box and pan break, 36"
Shear, 10", 16-gauge
Squaring shear, 36"
Floor shear, ½"capacity
Floor shear, 30"
Angle shear, 3/16" x 2" x 2" capacity
Ring and circle shear
Electric shear, 13 gauge capacity
Cradle for electric shear
Arc welder, 250-amp, 240-volt, 3-phase
Arc welding booth and table (with curtains), 60" x 60" x 75"
Oxyacetylene welding booth and table, 36" x 108" x 35"
Spot welder, 240-volt, 3-phase
MIG welding machine
TIG welding machine
Welding exhaust fan, ½ horsepower, 120-volt
Soldering iron, #2
Marble slab, 14" square
Acid brushes
Soldering scraper
Universal bending machine
Buffer, 7", ½ horsepower, 120-volt
Pedestal wire brush, 12". 1½ horsepower, 240-volt, 3-phase
Drill press, 17", 1 horsepower, 240-volt, 3-phase
Drill press, 20", 1½ horsepower, 240-volt, 3-phase
Double seaming machine
Burring machine
Belt sander, 6" x 48", 1 horsepower, 240-volt, 3-phase

Disc sander, 14”, 1 horsepower, 240-volt, 3-phase
Rotary machine with die assortment
Soldering furnace
Air compressor (located outside laboratory), 60 gallon tank, 5 horsepower, 240-volt, 3-phase
Spray booth (explosion-proof), 24” fan, ½ horsepower,120-volt
Foundry exhaust fan, ½ horsepower, 220-volt
Anvil with stand, 100 lb.
Bench machines and equipment
Adjustable bar folder, 30”
Wiring machine
Burr, large
Turner, small Buffalo
Elbow edging faces (for small turner)
Setting-down machine wit stand
Beader with stand
Crimping rolls (for beader)
Groover, 30”
Slip roll former, 2” x 30”
Stationary vise, 3½” jaw

Hand Tools and Equipment

Snips, straight-cut, right-cut, and left-cut aviation
Hollow-punch set, 3/8”, ½”, ¾”, and 1”
Solid-punch set, 5/32”, 9/64”, and 9/32”
Portable lever punch
Prick punch
Hammers. raising #3, setting, and riveting
Pliers, 6” round-nosed and flat nosed
Screwdrivers, 4”, 6”. and 8” plastic-handled
Bench shear
Rivet sets, #0 and #5
Grooving-tool sets, #3 and #5
Cutting nippers
Countersink (for metal)
Wire gauge
Steel square, 2”
Wing divider with solid-steel legs, 8”
Benches
Sheet metal bench
Bench for bar folder and forming machine, 4’ x 3’, 28” high
Stake bench with stake assortment
Hexagonal bench (for other machines), 6’ across
Bench for soldering, 2½’ x 18’

Racks
Sheet metal rack, 96” x 50” x 24”
Bar stock rack, 240” x 48”
Bar stock rack, 120” x 48”
Stakes
Bead horn stake, #2
Double seaming state, #1
Blowhorn stake
Creasing stake with horn
Needle case stake
Hatchet stake, #3
Bottom stake, #1
Solid mandrel, #0
Bench plates, #1, 8” x 37”
Common square stake
Basic Tool Set for Sheet Metal Workers
Toolbox
Awl
Bulldog shears
Combination shears
Grooving tool
Hacksaw
Aviation snips, left-cut and right-cut
Pliers
Regular vise grips
Screwdrivers
Prick punch
Tinner’s hammer
Straight tongs
Rivet set
Quick set (dividers)
Combination square
Folding-inside measuring rule
Steel measuring tape
Chalk line
Plumb bob
Gloves
Apron
Safety glasses, OSHA requirements

Machine Shop

Facility

Type/Use of Area	Recommended Square Footage
Laboratory	4200
Precision Measurement	500
Classroom/Instruction	700*
Storage	500
Teacher Office/Conference	150
Clean-up/Lockers – Boys	40-50
Clean-up/Lockers – Girls	40-50

* State requirement, Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities

Welding

The American Welding Society (AWS), recognizing the need for competent welding specialists, prepared the *Guide for the Design of a Welding Training Facility* to give guidance in building or converting facilities to train welders to produce welds using the manual and semi-automatic welding processes commonly found in industry. These guidelines do not purport to be all-inclusive. Modifications should be made to best accommodate the facilities and budget of the institution that is implementing a welding instructional program.

Laboratory
The various work stations in a laboratory should (1) provide a place at which students can develop skills and techniques necessary to develop welding competencies; (2) provide an area in which power sources, equipment, and projects may be secured and serviced; (3) provide special fixtures and production work mock-ups to adequately demonstrate the production work expected of various industries; and (4) provide an area where the teacher may demonstrate the skill and techniques necessary to develop welding competencies. A minimum of 100 square feet of laboratory floor space per individual is considered a good general planning figure, exclusive of washroom, storage, office space, and the classroom. Local and state requirements should be taken into account. Tools and supplies should be located as near to work areas as practical to reduce travel and interferences.

Classroom
Ideally, the room for instruction should be adjacent to the laboratory. It should be acoustically insulated from laboratory noise. The classroom should provide a clear but protected view of the laboratory area. T his space should have chalk and tack boards, a demonstration table, adequate classroom seating and work areas, and provision for darkening (for use with visual aids.) A bulletin board should near the main entrance. Adequate storage for audio-visual equipment, charts, models, samples, reference texts, etc., should be provided. Exhibit cases have strong appeal to parents and observers, especially when located to permit viewing from the outside corridor.

Storage
Decentralized storage should help conserve space and increase efficiency by reducing individual traffic. A storage area of at least 25’ long with a door centered at both ends permits both the economical purchase of steel in long lengths and wall storage within the room. Use of horizontal or vertical racks depends on space limitations and personal preference. Storage of bulk supplies (adequately secured) should be located adjacent to an outside service door for convenient delivery.

Adequate filler metal storage should be considered and should be controlled. Rod, wire, and fluxes, depending on their nature, must be maintained under certain storage conditions. The materials of higher value or requiring temperature control will require tighter controls to ensure that product quality is retained. Acquisition of an electrode storage oven is highly recommended.

Open tool cabinets in each process area helps conserve personnel time and travel while helping them associate proper tool selection and application with a particular activity. Space

underneath benches and tables is excellent for storage of hardware, small amounts of raw stock or even small projects. Storage of welding projects and personal belonging is always a problem and should be well thought out.

Cylinder storage should be located near the laboratory but accessible to truck traffic. All volatile materials should be stored outside in an identified, isolated area to minimize the potential hazards involved. Cylinder storage should follow the guidelines set forth in ANSI/ASC Z49.1 Safety, Cutting, and Allied Processes, Part II Specific Processes,, 10.8.2 Cylinder Storage.

One door in the storage area should open directly to the outside from this room so that stock may be loaded into the room with no interference to laboratory activities. Scrap storage can be located near this entrance. Materials storage areas or rooms should be located conveniently for issuing materials to the students, for cutting large stock to project size, and for the unloading of delivery trucks.

Personal Services
Personal services should be planned into the laboratory, for both convenience and efficiency. Individual lockers for books and clothing should be near the entrance to keep these items out of the main instructional area. A wash-up sink and water fountain and, where possible, a lavatory for both genders should be included near the entrance.

Budget
Adequate financial resources should be provided to not only maintain the program, but also enhance it. Funding for power sources, filler metals, gases, and fluxes along with power equipment an hand tools covers just the basics. Additional funds should be available to provide for the pedagogical materials needed for welding instruction. The budget should also include release time , travel, etc., for teachers to participate in their technical and professional development.

Lighting
The absolute minimum lighting recommended for general work in any laboratory is 100 foot-candles, while 140 foot-candles is recommended for more difficult or inspection work. The use of indirect lighting or semi-indirect lighting to avoid glare, provide shadow-free light, and evenly diffuse the light is recommended. When needed, individual machines can be lighted by lamp attachments or through their own built-in lighting systems. Each booth should have adequate lighting as well.

Electricity
Electrical power should be supplies with adequate voltage and amperage for each power in source in the laboratory and classroom. Electrical service should be 200/208-volt, 230/240-volt, single-phase or three-phase, and 60 cycle (60 Hertz), alternating current. Current capacity of 75% more than the estimated demand should be provided for expansion in the welding facility. Electrical outlets of 110/120-volt service should be placed at convenient locations every 12 feet (3.7 meters) and in every booth.

Ground fault interrupters should be provided throughout the laboratory. The use of magnetic starters on all rotary equipment is an additional safety feature that gives a machine

motor overload protection as well as low-voltage and no-voltage protection. After a power failure has been corrected, the machine will not start (even if it was running when the failure occurred) until the operator presses the start button.

A disconnect switch that can be locked out, must be provided to cut off all power equipment, including power sources, in the laboratory. Panic switches should be strategically located around the entire laboratory and their locations known by all students. They shall be wired to cut off power to every machine. Fused disconnect switches should be provided for each power source and there should be no exposed wiring.

Ventilation

Individual, movable exhaust hoods are highly desirable at the work site. Welding station exhaust should be separate form other laboratory exhaust systems. The minimum required air velocity at the zone of welding is 100' per minute (.5 meters per second) when the hood is at its farthest position from the joint being welded. The hood size and height can be reduced to lower the required capacity of the exhaust system. The use of a qualified heating, ventilation, and air conditioning (HVAC) contractor is strongly recommended, rather than having an inexperienced sheet metal firm perform the construction. Fire resistant, safety yellow, strip curtains can be lowered to form a booth when greater exhaust efficiency is desired at the demonstration area.

For the single welding booth, it is practical to design a hood exhaust system. Where there are a large number of booths being used, it is more practical to provide exhaust at the arc than for the entire room. However, the loss of heat during the cold months is a serious objection to the room ventilation method unless a heated air intake system is used. To avoid this heat loss, an air filtration system, which cleans the exhausted air and reintroduces it back into the laboratory to save heat and air conditioned air, should be used. These units need careful placement as welding creates more than most industry applications due to large numbers of units in a contained work area.

Heating

Heating and cooling capacity must take into consideration the provision for a supply of fresh, clean incoming air. The laboratory heating system should automatically maintain a temperature of 68ºFahrenheit (20º Celsius) measured 60" above the floor. The classroom and the office should be kept at 70º Fahrenheit (21º Celsius) measured 30" (762 millimeters) above the floor. A system of even heat distribution should be kept within 5% of these temperatures for health reasons and for stability of equipment and stored materials

Water

Hot and cold running water, along with a suitable drinking fountain in the laboratory, and convenient, sanitary restrooms nearly are necessities. Washing facilities of either the half round or trough type sink are essential and, as a rule, should be adequate to accommodate one quarter of the students at one time. Location of the washing facilities should be as near the door as feasible. A safety shower and eyewash station should be located within the laboratory area. Proper drainage should be included, as needed.

Safety

All safety features of the laboratory and its support systems must conform to any local state, or federal governing codes. The school must be able to pass an inspection of the local and state Fire Marshall and posses a certificate of conformance from the regional OSHA engineer.

Information regarding safety can be found in ANSI Z49.1 (Safety in Welding and Cutting), AWS F2.2 (Lens Shade Selector), AWS F3.1 (Guide for Welding Fume Control), AWS F4.1 (Recommended Safe Practices for the Preparation for Welding and Cutting of Containers That Have Held Hazardous Substances), as well as all other applicable local, state, and federal regulations. Equipment must conform to the OSHA requirements for “lockout and tagout.”

Welding

Facility

American Welding Society (AWS) recommended Welding Facility to accommodate 16-20 students:

Type/Use of Area	Recommended Square Footage
Laboratory	2000 or 100 sq. ft. per student
Demonstration area	100
Welding booth(s)	6" x 6"
Classroom/Instruction	700*
Storage (tools and equipment)	400
Storage (Bar stock)	25" long x 7" wide
Storage (Scrap)	60
Storage, OSHA-approved Outdoor, (gas cylinders)	60
Teacher Office/Conference	150
Clean-up/Restroom/Lockers – Boys	40-50
Clean-up/Restroom/Lockers – Girls	40-50
Emergency eyewash and drench shower	16 minimum

* Start requirement, Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities

Special Considerations-Primary Structure(s):

1. Building should be fireproof; walls should be smooth, with no ledges to collect dust.
2. Floors should be fire resistant, waterproof, and contain adequate floor drains.
3. Walls should be prepared with a low reflective paint to reduce ultraviolet radiation. "Cool" colors – blues or greens - recommended.
4. Doors should be large enough to permit easy entry of large pieces of equipment or overhead door.
5. Machines and equipment should be enclosed in "safety zones" painted on the floor.
6. Wide aisles (3 feet) between benches, machines, in front of tool cabinets and storage areas.
7. Designate aisles of travel by painted lines similar to those used in industry.
8. Non-skid surfaces such as sand on shellac should be applied to the floor in the area around machines to minimize danger of slipping.
9. Welding/process booths must be constructed of fire resistant material, with the walls open at least 12 inches at the bottom to permit air circulation. All four sides of the welding booth shall provide complete protection from harmful rays and hot sparks.
10. A disconnect switch that can be locked out must be provided to cut off all power equipment including power sources in the laboratory/shop.
11. Panic switches should be strategically located around the entire laboratory/shop and their locations known by all welding personnel. They should be wired to cut off power to every machine.
12. Fused disconnect switches should be provided for each power source and there should be no exposed wiring.

13. Individual, movable exhaust hoods are highly desirable. Welding station exhaust should be separate from other laboratory exhaust systems. The minimum required air velocity at the zone of welding is 100 feet per minute when the hood is at its farthest position from the point being welded. Refer to ANSI/AWS Standard F3.1-89, *Guide for Welding Fume Control*.
14. Fire resistant, safety yellow, strip curtains could be lowered to for a booth when greater exhaust efficiency is desired at the demonstration area.
15. Outside and inside facility warning signs for people wearing contact lenses that electrical arcs will immediately dry out surface of the eyes and fuse contact lens to eye surface.

Instructional Equipment

The number of welding workstations should exceed the number of welding students enrolled. Ideally, there should be 25 percent more welding stations than there are welding personnel to provide for expansion of enrollment.

Most workstations should be equipped with multi-purpose, retractable power sources.

Stationary Power Equipment
Iron worker (1/2" x 12")
Pedestal drill press (Multi-speed, geared-head) 18" x 36"
Vertical band saw (12" x 12")
Horizontal band saw (6" x 6")
Pedestal grinder with wire wheel (12" x 2" arbor)
Pedestal grinder with wire wheel (10" x 2" arbor), wire wheel
Bench grinders, (7" x 5/8" arbor),
Belt and disc sander
Track type cutting torch
Rod and flux oven (300 pounds)
Bend test jig
Power shear (3/8" x 48") (optional)
Press break (3/16" x 48") (optional)
Power roller (1/4" x 24") (optional)
Monorail or overhead crane (1 ton) (optional)
Hydraulic arbor press (5 tone) (optional)
Rotary table (200 lbs.) (optional)
Pattern cutter (12" x 35") (optional)
Portable Power Equipment
7" disc-type hand grinders, 3 each
4" disc-type hand grinders, 3 each
6 " wheel-type hand grinders, 2 each
5" belt sander
Nibbler
3/8" electric drill, 3 each
½" electric drill
Pneumatic air grinder (optional)
Pneumatic air wrench set (optional)
Impact wrench set (optional)
Portable band saw (optional)
Minimum Individual Equipment
Safety glasses with side shields or safety goggles, ANZI /a87-1-1989 (one per student)
Hearing and/or ear protection
Welder's hat or skullcap

Welder's protective clothing (leather cape with sleeves and bib or leather coat)
Leather gauntlet welding gloves (for other than GTAW)
Leather gauntlet welding gloves (for GTAW)
High-top leather shoes (steel-toed safety shoes recommended)
Welding helmet with #10/#12 filter plate/lens and protective cover plate/lens in a flip or slide front
Welding helmet/face shield/goggles with appropriate #5/#7 filter plate/lens with protective cover plate/lens for OAW-#5, OFC-#5, and PAC-#9.
Spare spatter and filter lenses/plates for arc welding helmet and oxyacetylene goggles
Pocket calculator
Stop watch
Lead pencil and/or ball point pen
Soap stone with holder
Scribe with magnet
Combination square set
English/Metric Bench Rule
Steel tape measure, 10 foot
Fillet weld gauge
Ball peen hammer, 16 oz. (.45 kilogram)
Center punch
Cold chisel
Adjustable wrench, 10" (254 millimeters
Vice grips, 10" (254 millimeters)
Vice grip clamp, 10" 254 millimeters)
Allen wrench set
Combination pliers, 10" (254 millimeters)
Side cutting pliers or diagonal cutting pliers, 6" (152 millimeters)
Needle nose pliers, 6" (152 millimeters)
Mill file (bastard cut), 10" (254 millimeters)
Chipping hammer with or without wire brush
Carbon steel wire brush
Stainless steel wire brush
Copper plate for balling tungsten
Temperature indicting sticks
Oxygen fuel tip cleaner
Oxygen fuel striker

Training Materials

As it is impossible to include a complete listing of all training materials since new ones are constantly being developed, current ones improved and older ones withdrawn, instructors and administrators should augment this list on a regular basis and keep files on up-to-date training materials. Industry publications feature or advertise sources for equipment and training materials.

Base Metals for Welding Practice
Carbon steels
Stainless steel
Aluminum alloys
High strength, low alloy steels
Alloy steels
Cast irons
Copper alloys
Gases
For oxyfuel gas processes:
Acetylene and one other
For shielding gases:
Carbon dioxide
Argon
For plasma arc cutting, Air carbon arch cutting, and pneumatic tools:
Compresses air (90 lbs per square inch at 300 cubic feet per hour to each booth in lab)
Filler Materials and Fluxes
All appropriate filler metals and fluxes for the base metals listed above
Rod oven(s) shall be available for low hydrogen filler metals and appropriate SAW fluxes.

Cosmetology

89.53 Minimum Requirements for Both Private and Public Cosmetology Schools.
Texas Occupations Code Chapter 1602 and Its Companion General Rules and Regulations including Sanitary Rulings. Texas Cosmetology Commission, April 2000.

Facilities

Type/Use of Area	Required Square Footage
Cosmetology Department	2200 minimum
Laboratory	1200, minimum
Dispensing/Storage	50 contiguous, minimum
Classroom, adjacent to laboratory	700*
Teacher Office	150
Lockers/Dressing rooms-Boys	40-50
Lockers/Dressing rooms/-Girls	40-50

*State Requirement Chapter 61 School Districts, § CC. Commissioners Rules Concerning School Facilities.

Special Considerations:

1. GFI electrical receptacles on each work station
2. Shelf and closed cabinet on wall above ach shampoo bowl.
3. Emergency disconnect switch to all equipment and outlets except lights.
4. Telephone in teacher's office.
5. Requires accessibility to the public and to public parking to accommodate client movement to and from the laboratory.
6. Classroom must be separate from the laboratory area by walls extending to the ceiling.
7. Dispensary must have a double sink with hot and cold running water and space for storage and dispensing of supplies and equipment.
8. Proper ventilation with exhaust fan or air-filtering device extracting fumes and gases out of the facility must be provided.

Classroom Equipment

One chalkboard
Desks and chairs or table space for a minimum of 10 students (plus space for additional students enrolled and in attendance per theory class
Textbook for each student enrolled
Charts:
Bones
Muscles
Nerves
Skin
Nails
Medical Dictionary
Visual Aids: VCR/monitor at a minimum

Laboratory Equipment

Type	Minimum Quantity*
Styling stations with mirrors	16
Hydraulic or swivel	
Formica or similar material	
Shampoo bowls with chairs	6
Hair dryers with chairs	8
Heat cap or therapeutic light	1
Cold wave rods	8 dozen
Electric curling irons	3
Mannequins with sufficient hair	12
Table or attached to styling stations	
Day/date formatted computer time clock	1
Professional hand clippers	1
Professional hand held hair dryers	3
Manicure tables with tools	4
Closed cabinet for clean towels	1
Covered container for soiled towels	1
Covered trash cans in lab area	4
Wet disinfectant soaking container	1 large
Dry storage container for disinfected implements	1

Facial Course Equipment

Facial chair
Magnifying lamp
Woods lamp
Dry sanitizer
Steamer
Brush machine for cleaning
Vacuum machine with spray device
High frequency for disinfect ion, product penetration, stimulation
Galvanic for de-incrustation, product penetration
Paraffin bath and paraffin wax

Transportation Systems

NATEF Facilities Standards

The National Automotive Technicians Education Foundation (NATEF) recommends that the physical facilities be adequate to permit achievement of the program goals and performance objectives.

Standard 1-Training Stations. Training stations (bench and live work) should be available in the type and number required for the performance of task outlined in the program goals and performance standards.

Standard 2-Safety. The facilities should meet all applicable safety standards and an emergency plan should be in place and posted in all classrooms and laboratory/shop areas.

Standard 3-Maintenance. A regular maintenance program should be used to ensure facilities are suitable when required for instruction.

Standard 4-Housekeeping. The classroom, laboratory/shop, and support areas should be kept clean and orderly.

Standard 5-Office Space. An area separate from the laboratory/shop should be available and convenient for the instructor's use as an office.

Standard 6-Instructional Area. A classroom convenient to, bur separate from, the laboratory/shop area should be available for instruction and other non-laboratory/shop activities.

Standard 7-Storage. Storage areas for tools, parts, supplies, and automobiles should be sufficient to support the activities outlined in the program goals and performance objectives. Security should be provided to prevent pilferage and vandalism.

Standard 8-Support Facilities. Restrooms, clean-up areas, and lockers should be provided for both male and female students and should be convenient to the instructional area.

Standard 9 Ventilation. An adequate exhaust removal system should be in place and operational. When appropriate, heating and cooling systems should be used to provide sufficient comfort for learning.

Standard 10-First Aid. A first aid kit should be in place and comply with local regulations.

Standard 11-Facility Evaluation. The Advisory Committee should conduct an annual evaluation of the facilities to assure adequacy to meet program goals.

Tools and Equipment

The National Automotive Technicians Education Foundation (NATEF) recommends that tools and equipment used in the Automotive Technician program address the following issues:

1. **Safety** – Equipment and tools must have all shields, guards, and other safety devices in place, operable, and used.
2. **Type and Quality** – The tools and equipment used in an Automotive Technician program must be of the type and quality found in industry. The must also be adequate and in sufficient quantity to meet program goals and student performance objectives.
3. **Consumable Supplies** – Supplies should be in sufficient quantity to assure continuous instruction. Consumable supplies, such as solvents, sand paper, etc., are not included in the Tools and Equipment Lists.
4. **Maintenance** – A preventive maintenance schedule should be used to minimize equipment down time.
5. **Replacement** – A systematic schedule for replacement should be used to maintain up-to-date tools and equipment at industry and safety standards. Information from student program evaluations as well as advisory committee input should be used in the replacement process.
6. **Inventory** – An inventory system should be used to account for tools, equipment, parts, and supplies.
7. **Parts Purchasing** – A systematic parts-purchasing system should be used, from work order to supplier.
8. **Hand Tools** – Each student should be encouraged to purchase, or arrange for a mentor to provide each student, a hand tool set during the period of instruction.
9. **Storage** – Adequate storage of tools should be provided. Space for storage of students' hand tools should provided.

Automotive Technology

Facility

NATEF recommended Automotive Technology Facility to accommodate 16-20 students.

Type/Use of Area	Recommended Square Footage
Laboratory/shop	2800-3600
Fenced area adjacent to laboratory for storage of automobiles	1200
Engine Overhaul	500
Classroom/Instruction	700*
Storage (tools and equipment)	400
Storage (Oil)	40-50
Teacher Office/Conference	150
Clean-up/Restroom/Lockers – Boys	40-50
Clean-up/Restroom/Lockers – Girls	40-50
Emergency eyewash and drench shower	16 minimum

* State requirement Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities.

Special Considerations:

1. Direct access to service drive with separate entrance and exit doors (unless space is designed so that each service stall opens directly onto service drive).
2. Electric overhead doors.
3. Convenient or direct access to Collision Repair and Refinishing laboratory and to welding laboratory, if offered.
4. Bays should provide for at least half with hoist and half without hoist.
5. Provision should be made for one enclosed wash rack with drain.
6. Adequate lighting, 100-foot candles, in car stalls with units parallel to stalls.
7. Workbenches require adjustable task lighting.
8. Two each 110-volt single phase current with appropriate grounds located at 101 intervals, no outlet less that 4' above floor; 220-volt 3-phase current in stall areas only.
9. Grease and oil traps or other provisions for handling grease and oil.
10. Accommodations for oil and coolant recycling.
11. Provide hazardous materials storage.
12. Positive exhaust system to remove fumes and smoke from shop.
13. Exhaust system in floor with at least two exhaust units in each car stall and one at each engine stands. Connecting tubes must be rust resistant and have easy means of recess or be of the type that is not injured when driven over. Must be designed for easy cleaning of exhaust system.
14. Provide gutter system beneath all automobile working stations; design system for easy cleaning. Water must be available for flushing or other arrangement that concentrates and drains water from cars; provide sediment trap.
15. Hose bibbs inside and outside.

16. Water for floor washing and for test-stand-cooling of engines to eliminate pans but requires floor drains with grease traps.
17. Free area with space to work on mock-ups and other related activities.
18. Compressed air available at all work stations, 100-150 psi, with water separator in line to remove all moisture from air.
19. Computer terminals in laboratory and classroom/instructional area.
20. Optional overhead hoist system should serve entire laboratory/shop area.

General Laboratory Equipment

A well equipped Automotive Technician program should have all of the following tools and equipment for general laboratory/shop work. They should be readily available and in sufficient quantity to provide quality instruction.

Air Chisel Set with various bits
Air Compressor and Hoses
Air Pressure Regulator
Air Ratchet, 3/8" drive
Automotive Stethoscope, electronic recommended
Axle Stands (Safety Stands)
Battery Charger
Battery/Starter/Charging System Tester
Bearing Packer, hand operated
Belt Tension Gauge
Bench or Pedestal Grinder
Compression Tester
Personal Computer (PC) with interface capability for on-board diagnostics (OBD II compliant recommended or Computer Scan Tool (hand held)
Coolant/Combustion Gas Detector, recommended
Coolant Tester
Cooling System Pressure Tester and Adapters
Constant Velocity Joint (CV) Service Tools:
Boot Installation Tool
Boot Clamp Pliers or Crimping Ring
Creeper
Cylinder Leakage Tester
Dial Indicator with Flex Arm and Clamp Base
Digital Multi-meter with various lead sets
Drain Pans
Drill, 3/8" variable speed, reversible
Drill, ½" variable speed, reversible
Electric Heat Gun
Engine Coolant Recovery Equipment or Recycler or Coolant Disposal Contract Service
Extension Cords
Face Shields
Fender Covers

Floor Jack, 1½ ton, minimum
Hand-held Vacuum Pump
Hoist(s)
Hydraulic Press with adapters
Impact Socket Sets:
3/8" Drive, standard and metric
½" Drive (7/16"-1 1/8")
½" Drive (12mm-24mm)
½" Drive Deep (30mm, 32mm, 36mm)
Impact Wrenches: ½" Drive and 3/8" Drive
Jumper Cables
Master Puller Set
Micrometer (Depth)
Micrometers: 0-1", 1-2", 2-3", 3-4", 4-5"
Oil Filter Wrench
Oxy-Acetylene Torch
Parts Cleaning Tank and Gloves (non-solvent based cleaner recommended)
Remote Starter Switch
Screw Extractor Set
Seat Covers
Snap Ring Pliers Set – External
Snap Ring Pliers Set - Internal
Soldering Gun
Soldering Iron, 25-watt pencil tip
Spark Plug Boot Puller
Tach/Dwell Meter
Tap and Die Set – Standard
Tap and Die Set – Metric
Thread Repair Insert Kit
Tier Inflator Chuck
Trouble/Work Lights, fluorescent preferred
Tube Quick Disconnect Tool Set
Tubing Cutter/Flaring Set, double tap and ISO
Twist Drill Set, 1/64"-1/2"
Valve Core Removing Tool
Vernier Calipers: o-6" and 0-125mm
Waste Oil Receptacle with extension neck and funnel
Workbenches with vises

Hand Tools

(Contained in individual sets or the tool crib in sufficient quantities to permit efficient instruction.)

Adjustable Wrenches: 6” and 12”
Air Blow Gun, meeting OSHA requirements
Allen Wrench or Socket Set: Standard (.050”-3/8”)
Allen Wrench or Socket Set: Metric (2mm-7mm, 10mm, 12mm)
Battery Post Cleaner
Battery Terminal Pliers
Battery Terminal Puller
Brake Spoon
Chisels: Cape 5/16”, Cold 3/8”, ¾”
Chisel Holder
Claw Type Pickup Tool
Combination Wrenches:
Standard (¼”-1¼”)
Metric (7mm-24mm)
Crowfoot Wrench Sets – Metric and Standard
Ear Protection
Feeler Gauge (Blade Type): .002”-.040” and .006mm-.070mm
Files: Coarse 6” and 12”, Fine 6” and 12”, Half Round 12”, Round 6” and 12”
Flare Nut (tubing) Wrenches: 3/8”-3/4” and 10mm-17mm
Flashlight
Fuse Puller
Hack Saw
Hammers: 16 oz. Ball Peen, Dead Blow Plastic Mallet, Plastic Tip, Rubber Mallet
Inspection Mirror
Jumper Wire Set with various adapters
Magnetic Pickup Tool
Pliers: Combination 6”, Hose Clamp, Locking Jaw, Needle Nose 6”, Side Cutting, Slip Joint (Water Pump)
Pry Bars: Rolling Head and Straight
Punches: Center, Brass Drift, Pin 1/8”, 3/16”, ¼”, 5/16”, Taper 3/8”, ½”, 5/8
Safety Glasses, ANZI A87.1-1989 (one per student)
Scrapers: Carbon 1” and Gasket 1”
Screwdrivers, Blade type: Stubby, 6”, 9”, 12”, Offset
Screwdrivers, Phillips: Stubby #1, #2, 6”, #1, #2, 12” #3, Offset #2
Screwdriver, Impact Driver Set
Screw Starters: Phillips and Standard
Socket Set ¼” drive:
¼”-½” standard depth
¼”-½” deep
6mm-12mm standard depth
6mm-12mm deep

Flex/Universal Type
Ratchet
Socket Set-3/8: d rive:
5/16”-3/4” standard depth (6point)
3/8”-3/4” deep (6 point)
10mm-19mm standard depth
10mm-19mm deep
3”, 5”, 10” extensions
Flexhead ratchet
Ratchet
Spark Plug Sockets, 5/8” and 13/16”
Universal joint
Flexible Socket Set 3/8”-3/4”
Flexible Socket Ser 10mm-19mm
Socket Set-1/2” Drive:
7/16” –1 1/8” Standard Depth
7/16” 1 1/8” Deep
10mm-24mm Standard Depth
10mm-24mm Deep
3”, 6”, 12” Extensions
Flex Handle (Break Bar)
Ratchet
Spark Plug Feeler Gauge (Gap tool)
Tape Measure-Standard and Metric
Test Light (12V)
Tire Pressure Gauge
Torque Wrenches: 3/8” Drive (10-250 lb.), 3/8” Drive (5-75 lb. ft.), ½” Drive (50-250 lb.ft.)
Torx® Set (screwdrivers and/or sockets)

Specialty Tools and Equipment

This tools and equipment are specialized for use in the Automotive Specialty areas and must be available in the laboratory/shop or to the program. Specific types or brands are not identified, as they will vary in each local situation.

Suspension and Steering
Ball Joint Press and other special tools
Brake Pedal Depressor
Hand Grease Gun
Inner Tie Rod End Tool
Pitman Arm Puller
Power Steering Pump Pulley Special Tool Set (appropriate for units being taught)
Shock Absorber Tools
Spring/Strut Compressor Tool
Steering Column Special Tool Set (appropriate for teaching units being utilized)

Tie Rod Puller
Tire Mounting Machine (rim clamp suggested)
Wheel Alignment Equipment-4 wheel (including alignment tools)
Wheel Balancer – Electronic Type
Wheel Weight Pliers
Brakes
Brake Bleed, pressure
Brake Disc Micrometer
Brake Drum Micrometer and Calibration Equipment
Brake Lathe with disc and drum service attachments (mobile or stationary)
Brake Shoe Adjusting Gauge
Brake Spring Remover/Installer
Brake Spring Pliers
Bearing Seal and Race Drive Set
Heating and Air Conditioning
A/C Compressor Clutch Service Tools
A/C Service Port Adapter Set
Leak Detector (SAE Standard)
Manifold Gauge Set, (R-12 and HFC-134) or equivalent
Refrigerant Charging Station (R-12 and HFC-134A) or equivalent
Refrigerant Identification Equipment (suggested)
Refrigerant Recovery/Recycling Machine (R-12 and HFC 134)
Thermometer
Engine Performance
Dual Trace Lab Scope
Engine Analyzer with ignition display capability
Four or Five Gas Exhaust Analyzer
Fuel Injection Cleaner
Fuel Injection Pressure Gauge Sets with Adapters
Injector Pulse Tester
Logic Probe (suggested)
Oxygen Sensor Socket
Pinch-off Pliers
Sending Unit Socket(s)
Spark Plug Thread Tap
Spark Tester
Static Wrap
Timing Advance Light
Vacuum/Pressure Gauge
Automatic Transmission/Transaxle
Hydraulic Pressure Gauge Set
Front Wheel Drive Engine Support Fixture

Transaxle Removal and Installation Equipment
Transmission Jack(s)
Transmission/Transaxle Holding Fixtures
Transmission/Transaxle Special Tool Sets (appropriate for the units being taught)
Electrical/Electronic Systems
Battery Hydrometer
Connector Pick Tool Set
Headlight Aimer or Screen
Wire and Terminal Repair Kit
Manual Drive Train and Axles
Clutch Alignment Set
Clutch Pilot Bearing/Bushing Puller/Installer
Front Wheel Drive Engine Support Fixture
Transaxle Removal and Installation Equipment
Special Tools for Transmissions/Transaxles (appropriate for units being taught)
Transmission/Transaxle Holding Fixtures
Transmission Jack(s)
Universal Joint Tools
Engine Repair
Ball (Small Hole) Gauges
Cam Bearing Driver Set (suggested)
Cylinder deglazer
Dial Bore Indicator
Engine Stands/Benches
Inside Micrometer Set; 0-6” and 0-125mm
Oil Pressure Gauge or equivalent
Oil Priming Tool (oil pump drive)
Outside Micrometer Set: 0-6” and 0-125mm
Portable Crane, ½ ton
Ridge Reamer
Ring Compressor
Ring Expander
Ring Groove Cleaner
Straight Edge
Telescopic Gauge Set
Torque Angle Gauge
Transaxle Remover and Installation Equipment
V-Blocks
Valve and Valve Seat Resurfacing Equipment
Valve Guide Repair Tools
Valve Spring Compressor
Valve Spring Tester

NATEF Collision Repair & Refinishing Facilities Standards

The physical facilities must be adequate to permit achievement of the program goals and performance objectives.

Standard 1. Training Stations Training stations (bench and live work) should be available in the type and number required for the performance of task outlined in the program goals and performance objectives.

Standard 2. Safety The facilities should meet all applicable safety standards and an emergency plan should be in place and posted in all classrooms and laboratory/shop areas.

Standard 3-Maintenance. A regular facilities maintenance program should be used to assure facilities are suitable when required for instruction.

Standard 4-Housekeeping. The classroom(s), laboratory/shop, and support area(s) should be kept clean and orderly.

Standard 5-Office Space. An area separate from the laboratory/shop should be available and convenient for the instructor's use as an office.

Standard 6-Instructional Area. A classroom convenient to, but separate from, the laboratory/shot must be available for instruction and other non-laboratory/shop activities.

Standard 7-Storage. Storage areas for tools, parts, supplies, and automobiles should be sufficient to support the activities outlined in the program goals and performance objectives. Security should be provided to prevent pilferage and vandalism.

Standard 8-Support Facilities. Restrooms, clean-up areas, and lockers should be provided for both male and female students and should be convenient to the instructional area.

Standard 9-Ventilation. An adequate exhaust fume removal system should be in place and operational. When appropriate, heating and cooling systems should be used to provide sufficient comfort for learning.

Standard 10-First Aid. A first aid kit should be place and comply with local regulations.

Standard 11-Facility Evaluation. The Advisory Committee should conduct an annual evaluation of the facilities to assure adequacy to meet program goals.

Tools and Equipment

The National Automotive Technicians Education Foundation (NATEF) recommends that local employer needs and the availability of funds are key factors for determining the structure and operation of each Collision Repair & Refinishing program. While not all programs have the same needs nor do all programs teach 100% of the NATEF tasks, the each training program should be as thorough as possible using the tools and equipment necessary for students to attain course objectives.

While referring to the tools and equipment lists for Collision Repair & Refinishing, please note the following:

1. The organization of the tool list is not intended to dictate how a program organizes its tool crib or student tool sets (i.e., which tools should be in a student set, if utilized, and which should be in the tool crib or laboratory/shop area.)
2. Quantities of each tool or piece of equipment are determined by local program needs; however, sufficient quantities to provide quality instruction should be on hand.
3. For Specialty Tools and Equipment, the program need only have those tools for the areas being taught in the specific program.
4. Programs may meet the equipment requirements by borrowing special equipment or providing for off-site instruction (e.g., in a dealership or independent repair shop).
5. No specific brand name for tools and equipment are specified or required; however, the tools and equipment should be of the type and quality found in industry.
6. Industry surveys indicate that most (90%) of employers require that a candidate for employment provide his/her own basic hand tool set in order to be hired as an entry-level automotive technician. Students should be encouraged to begin to build their own individual tool sets prior to entry into the industry.

Collision Repair and Refinishing

Facility

NATEF recommended Collision Facility to accommodate 16-20 students.

Type/Use of Area	Recommended Square Footage
Laboratory	3700
Paint booth	300
Fenced area adjacent to Laboratory	1200
Classroom/Instruction	700*
Storage (tools and parts)	500
Storage (paint)	100
Teacher Office/Conference	150
Clean-up/Restroom/Lockers – Boys	40-50
Clean-up/Restroom/Lockers – Girls	40-50

* State requirement Chapter 61 School Districts, § CC. Commissioner's Rules Concerning School Facilities.

General Laboratory Equipment

The tools and equipment on this list are used in general laboratory/shop work but are not considered to be individually owned hand tools. A well-equipped program should have all of these general tools and equipment readily available and in sufficient quantity and capacity to provide quality instruction.

Air Blow Guns – OSHA Standard
Air System – Air Compressor
Air Hoses, with quick release couplings:
Air Lines
Regulator
Water Extractors
Air Transformer/Regulators
Corrosion Protection Application Equipment
Creepers
Exhaust Fans
Grounded Extension Cords
Heat Lamps
Jack Stands
Overhead Ventilation, for welding area
Oxy-acetylene Torch Set
Portable Floodlights
Powered Vehicle Mover (recommended)
Service Jacks
Shop Brooms
Dust Pans
Floor Squeegee

Floor Mop and Bucket
Storage Cabinets
Trash Cans in accordance with local, state, and federal regulations
Work Benches, steel top with vice
Work Stands, portable
Special Safety Items **(All must meet or exceed federal, state, and local regulations)**
Blood-born Pathogen Kit
Ear Protection, for students, instructors, and visitors
Eye Wash Basin
Eye Wash Station, portable (saline)
Fire Blankets and Case
Fire Extinguishers, by type as required
First Aid Kit
Flammable Materials Storage Locker, meeting fire and building codes
Hazardous Spill Response Kit
OSHA "Right to Know" Compliance Kit
Protective Gloves and Clothing, for handling paint and related chemicals
Respiratory Protection Equipment, as required by OSHA
Safety Cans, for solvents, rags, etc.
Safety Glasses, Clear and Tinted Face Shields, and Goggles, for students, instructors, and visitors
Safety Shoes, as required*
*Safety Shower, as required
Vacuum System, for air sanders (recommended)

Hand Tools

(Contained in individual sets or the tool crib in sufficient quantities to permit efficient instruction)

Common Hand Tools
Adjustable Wrenches, 6" and 12"
Allen Wrench Set, Standard (.050"-3/8")
Allen Wrench Set, Metric (2mm-7mm)
Anti-freeze Drain Pan
Battery Post Cleaner
Battery Terminal Pliers
Battery Terminal Puller
Brake Spoon
Chisels: Cape 5/16", Cold 3/8", ¾"
Combination Wrenches: Standard (¼"-1"), Metric (7mm-19mm)
Crowfoot Wrench Set, Metric
Crowfoot Wrench Set, Standard
Digital Multimeter
Drill Motors, 3/8" and ½" variable speed, reversible

Feeler Gauge (Blade Type): .002”-.040” and .006mm-.070mm
Flare Nut (tubing) Wrenches: Standard 3/8”-3/4” and Metric 10mm-17mm
Flashlight and batteries
Hack Saw and blades
Hammers: 16 oz. Ball Peen, Brass, Dead Blow Mallet, Plastic Tip, Sledge, Soft Faced, Rubber Mallet
Ignition Wrench Set, Standard and Metric
Impact Wrenches, 3/8” and ½”
Inspection Mirror
Jumper Wire Set (with various adapters)
Oil Drain/Storage Pan
Oil Filter Wrenches
Pickup Tool, magnet and claw type
Pliers: Combination, Hose Clamp, Locking Jaw, Needle Nose, Side Cutting, Slip Joint (Water Pump),
Plier Set, Snap Ring, internal and external
Power Reciprocating Saw and blades
Punches: Center, Brass Drift, Pin: 1/8”, 3/16” ¼”, 5/16”, and Taper: 3/8”, ½”, 5/8”
Screwdriver, Blade type: Stubby, 6”, 9”, 12”, Offset
Screwdrivers, Phillips: Stubby, #1, #2, 6”: #1, #2, 12” #3, Offset #2
Screwdrivers, Posidrive Set: #1, #2, #3, #4
Screwdrivers:
Torx® Set: T-8, T-10, T-15,T-20, T-25, T-27, T-30,T-40, T-55
Torx® External Set: E-4, E-5, E-6, E-8, E-10, E-12, E-14, E-16
Torx® Tamper Proof Set: T8, T19, T15, T27, T30, T40, T45, T50, T55
Screw Extractor Set
Screw Starter: Standard and Phillips
Socket Set, ¼” drive:
¼”-½” standard depth
¼”-½” deep
6mm-12mm standard depth
6mm-12mm deep
Flex/Universal Type – standard and metric
¼” Universal Joint
3”, 6” Extensions
Ratchet
Socket Set - 3/8” drive:
5/16”-¾” standard depth (6 point)
3/8”-3/4” deep (6 point)
9mm-19mm standard depth
9mm-19mm deep
3”, 6”, 12”, 18” Extensions
Flexhead Ratchet
Impact Sockets – 3/8”-¾” standard
Impact Sockets – 10mm-19mm
Impact Driver

Ratchet
Speed Handle
Universal Joint
Socket Set - ½" Drive:
7/16"-1 1/8" Standard Depth
7/16"-1 1/8" Deep
10mm-25mm Standard Depth
10mm-25mm Deep
5", 10" Extensions
Flex Handle (Breaker Bar)
Impact Sockets Standard: 7/16"-1 1/8"
Impact Sockets 12mm-32mm
Impact Driver
Ratchet
Torque Wrenches (Sound /Click and Impulse Type):
3/8" Drive lb. (30-250)
3/8" Drive lb. ft.(5-75)
½" Drive lb. ft. (50-250)
Miscellaneous Tools
Caulking Gun
C-clamps – assorted
Files – for steel and aluminum
Hole Saw Set, ½"–2"
Lug Wrench
Oil Can (Pump type)
Rivet Guns, heavy duty blind and large for 3/16" and ¼"
Pry Bar Set
Putty Knife
Sanding Tools, assorted
Scrapers
Scratch Awl
Tap and Die Sets, Standard and Metric
Tape Measure, Standard and Metric
Tin Snips
Tire Pressure Gauge
Tire Inflator
Twist Drill Sets:
Standard: 1/64"-¼" by 1/16" and Metric Equivalent
Standard: ¼"-½" by 1/16" and Metric Equivalent
Wire Brushes, hand and powered
Special Removing and Releasing Tools:
Door handle removing tool
Door hinge spring and pin remover
Miscellaneous interior and exterior trim removing tools
Reveal moulding tools

Spring lock coupler tool set
Stationary glass removal tools
Windshield wider removing tool
Body Working Tools
Assorted Files, for metal and plastic finishing, including:
Body Files
Body Filler Shaping Files (Cheese Grater/Shredder)
Hand Sanding Pads
Metal Files
Sanding Blocks (short and long)
Sanding Boards (short and long)
Body Hammers:
Cross Chisel
Door skin Hammer
General Purpose Pick
Large Face Finishing
Long Pick
Short Utility Pick
Shrinking
Dollies:
Bumping File
Dinging Spoon
Door skin Dolly
Fender Dolly
Inside Heavy Duty Spoon
Inside High Crown
Inside Medium Crown
Spoon Dolly (“Dolly on a stick”)
Toe Dolly
Universal Dolly
Filler Spreaders and Applicators, assorted types and sizes
Picks, assorted
Punches and Chisels, assorted:
Air Chisel Set, various bits
Center Punch
Flat Chisels, ¼”-3/4”
Long Center Punch
Long Pin Punches, 1/16”-3/8”
Long Flat Chisels, ¼”-3/4”
Long Tapered Punches, 3/8”-5/8”
Pin Punches, 116”-3/8”
Punch/Chisel Holder
Round Nose Cape Chisel
Short Tapered Punches
Starter Punches, 1/16”-3/8”

Specialty Tools and Equipment

The following list covers the tools and equipment a laboratory/shop should have for training in any given specialty area. This equipment is specialized and it must be available in the laboratory/shop or to the program. No specific types or brand names are identified because they will vary in each local situation.

Non-Structural Analysis and Damage Repair
Abrasive Cut-off Tool and Discs
Abrasive Disc Shaper
Anchoring System
Car Lift (capable of totally lifting the vehicle)
MIG Welders and accessories
Plasma Cutting Torch (recommended)
Portable Hydraulic Ram with attachments
Pressure Washer
Portable Power Tools:
Abrasive Blaster and appropriate personal safety equipment
Die Grinder with attachments
Grinders
Metal Shears
Nibbler
Sanders
Pulling and Holding Equipment Set including:
Body Clamps
Cable or Chain Ratchet
Slide Hammer, complete with attachments
Stationary Power Tools: Bench Grinder and Drill Press (recommended)
Step Ladder
Structural Adhesive Guns (dispenser, two component)
Vacuum Cleaner
Welding Safety Equipment including:
Aprons
Face Shields
Gloves
Goggles
Helmets
Jackets
Respirators
Safety Glasses
Welding Blanket
And all appropriate safety equipment
Weld-on Pulling Tool and attachments

Structural Analysis and Damage Repair
Everything listed under Non-Structural Analysis and Damage Repair plus:
Frame/Unibody Straightening Equipment:
Bench/rack or floor-mounted system with multiple pull capacity
Self-centering Gauges
Universal Measuring System with minimum capacity to measure 2/3rds of the total vehicle using:
3 self-centering gauges
1 tram gauge
Strut tower measurement capability to simultaneously measure length, height, and width OR incorporating a mechanical (to include strut tower gauge assembly) Laser OR Computerized measuring system
Tram Gauges
Mechanical and Electrical Components
Refrigerant Recovery System for R12 and 134
Air-conditioning gauges, lead detector, and vacuum pump
Ball-joint Fork
Battery Bleeder, vacuum assisted
Chassis Lubricator
Connector Pick Tool Set
Cooling System Pressure Tester
Crane/Hoist, portable, 2-ton capacity
Gear Puller Set, heavy duty with attachments
Headlamp Aiming Equipment
Heat Gun
Hydraulic Press with adapters
Pitman Arm Puller
Soldering Gun/Iron
Spring/Strut Compressor Tool
Tie Rod Puller
Wheel Alignment System – 4-wheel+
Wire and Terminal Repair Kit
Plastics and Adhesives
Plastic Welder
Die Grinding Tool Set
Disc Grinder, 3”
Heat Gun
Structural Adhesives Guns (dispenser)-two-component
Painting and Refinishing
Air Cap Test Gauge
Air Sanders
Color-matching Light System
Dry Film Thickness Gauge with a + or 1/10th of a mil thickness capabilities

Enclosed Paint Spray Booth to comply with local, state, and federal regulation (downdraft booth recommended)
Hand Sanding Pads
Hazardous Material Spill Kit
Masking Equipment: Car covers paper and tape dispenser wheel covers
Paint Mixing Bank with measuring equipment
Paint Shaker
Paint Storage Room/Locker in accordance with local, state, and federal regulations
Personal Safety Equipment (painting gloves, suits, hoods, respirators, etc.)
Portable Paint Curing Equipment (infrared)
Prep Station (recommended)
Sanding Blocks (short and long)
Sanding Sponges
Spray Guns, HVLP/LVLP (high volume, low pressure/low volume low pressure)
Spray Gun Cleaning equipment in accordance with local, state, and federal regulations (Enclosed recommended)
Squeegees, assorted sizes
Supplied Air Respirator (SAR)
Variable Speed Buffer/Polisher
Waste Disposal/Recycling program in accordance with local, state, and federal regulations

Work-Based Learning

Type/Use of Area	Recommended Square Footage
Classroom/Instruction	700*
Storage	50
Teacher Office/Conference	150

Special Considerations:

1. Teacher office/conference areas should be contiguous to the classroom area and should provide visual access to the classroom.
2. Full-height adjustable shelving in storage room.
3. Bookcases and files cabinets in both classroom and teacher's office.
4. Tack or bulletin boards on available wall space.
5. Computer workstations with overhead shelving for storage.
6. Tables with rolling chairs should be considered in lieu of traditional student desks.
7. Dedicated Internet line.
8. Telephone in teacher's office.
9. TV/VCR
10. Overhead-mount AV screen

Color Coding

The way equipment and furniture is arranged in a laboratory is important. Many accidents occur from being in the wrong place or from conflicts in traffic flow. Color-coding improves the safety of the laboratory establishing boundaries, which identify safe or unsafe areas. Color-coding is a method of communication that tells the student where safety zones and equipment are and what is or is not safe.

Red – Identifies fire protection equipment, danger, and emergency stops for equipment. Fire extinguishers and fire alarm housing should be red to identify their location. Safety cans and containers of flammable liquids must be painted red with a clearly visible identification, either in the form of a yellow band around the container bearing a contents label or the contents clearly printed on the container in yellow. Danger signs and emergency power switches must also be painted red.

Orange – Alerts users to hazardous parts of machines that may shock, cut, crush, or injure. Use orange on exposed edges of cutting devices, pulleys, gears, inside surfaces of guards, transmission cases, and fuse boxes.

Green and White – Used to identify first aid and safety equipment. Use on first aid equipment and personal protective equipment storage areas.

Blue – Indicates precaution and is used to mark equipment or controls that should not be used.

Purple – Denotes radiation hazards.

Black and White – Used separately or in combination to denote housekeeping areas, such as the location of waster containers, brooms, and other clean-up materials.

For official information on use of colors, consult OSHA Standard 1910.144, which may be found at: www.osha-sl.gov/OshStd_data/1910-0114.html

Annex C
Recommendations for Facility Planning

C1. Welding Facilities

C1.1 Public School Systems. The training organization shall meet the requirements established by the School Facilities Commission for the state in which the school is located.

C1.2 Other Training Organizations—Private/Industrial. A training organization may choose to meet the requirements established by the School Facilities Commission for the state in which the school is located.

C1.3 Other Training Organizations—Private/Industrial. A training organization not using the requirements established by the School Facilities Commission for the state in which the school is located should combine the recommendations of their advisory committee and the following guide in establishing their School Welding Facilities.

C1.3.1 Primary Structure(s). The building should be fire proof and well designed. Welding instructional facilities will function best if located on the ground floor, preferably in a one story wing of the main building or in a separate building with covered access ways. Instructional areas in which noisy activities are conducted are best placed farthest from other academic areas of the school or production areas in an industrial facility. Walls should be smooth, with no ledges to collect dust. Floors shall be fire-resistant, waterproof, and contain adequate floor drains. A minimum light level of 100 foot-candles (100 candela) 30 in. (762 mm) from the floor is recommended. To enhance motivation and morale, adequate natural light from windows and skylights should be available. Walls should be prepared with a low reflective paint to reduce ultraviolet radiation. "Cool" colors, blues or greens, are recommended. The various work stations in a laboratory should meet the following objectives:

1. Provide suitable facilities where the instructor may demonstrate the skills and techniques necessary to develop welding competencies.

2. Provide a place at which the welding students may develop such competencies.

3. Provide an area in which power sources, equipment and projects may be secured and serviced.

4. For specific industry welding training facilities, provide special fixtures and production work mock-ups to adequately demonstrate the production work to be expected in order for all students to experience typical job related welding positions, conditions, and interferences.

A modular system of layout should be considered so that a two fold criteria for modern building planning (i.e., flexibility and expandability) can be achieved. The former is accomplished by allowing the maximum possible interchange of work stations and other facilities. Future expansion is planning in terms of multiples of specific work stations needed rather than in terms of the

general area to be added. These features would simplify the work of the architect, increase the usable life of the laboratory, and provide the instructor with more possibilities to offer curriculum changes.

The flexibility and expandability of laboratories should be greatly enhanced if architectural design permits use of non-load-bearing partitions between adjoining areas. Good planning includes the provision of doors large enough to permit easy entry of the largest piece of equipment into each shop. In addition, placement of such doors to permit the maximum degree of future flexibility with changes in partition locations should be considered.

If facilities are to be used for evening classes, easily accessible outside entrances which eliminate the necessity of opening or lighting other parts of the building offer important savings in operating and maintenance costs.

C1.3.2 Classroom(s). Ideally, a room for instruction should be about 20 ft (6.1 m) x 24 ft (7.3 m) and adjacent to the laboratory. Classrooms should provide a clear (but protective) view of the laboratory area. The minimum ceiling height should be 12 ft (3.7 m) or higher. Classrooms should be acoustically insulated from laboratory noise. This space should have chalk and tack boards, a demonstration table, adequate seating facilities and provision for darkening for the use of visual aids. At least one bulletin board should be near the main entrance. Instructors and welding personnel shall have normal access to the classroom. Storage for audiovisual equipment, charts, models, samples, reference texts, etc., needs to be provided. Exhibit cases have strong appeal to parents and observers, especially when located to permit viewing from the outside corridor.

C1.3.3 Laboratory. A minimum of 100 ft^2 (9.3 m^2) of laboratory floor space per individual is considered a good general planning figure, exclusive of washroom, storage, office space and the classroom. At the outset the architect and laboratory planner should take into account state recommendations as to minimum square footage per individual. While they vary from state to state, factors of 75 ft^2 (7.0 m^2) to 150 ft^2 (13.9 m^2) of work space per individual and a minimum of 400 ft^2 (37.2 m^2) to 800 ft^2 (74.3 m^2) for material storage are generally accepted requirements for this particular size area and the subjects to be taught. Floor dimensions of 40 ft (12.2 m) □ 85 ft (25.9 m) are reasonably close to the normally accepted length to width proportions of 2 to 1. The minimum ceiling (clearance) height should be no less than 12 ft (4.3 m). At least one entrance shall be large enough [14 ft (4.3 m) □ 14 ft (4.3 m)] to accommodate bulky materials, equipment and projects. Future expansion should always be considered. While projections of this nature are sometimes only educated guesses at best, adaptability of reorganization should be kept in mind. This should permit additional enrollment, new equipment, or extra shop Subjects to be reasonably accommodated without going below space-per-individual minimums.

Where a hazard exists around machines, the power equipment should be so placed that welding personnel are not in the line of danger. Added protection is given by enclosing this equipment in a safety zone painted on the floor. Wide aisles of travel should be provided between benches, machines, and in areas in front of tool cabinets and storage lockers. These aisles should be a minimum of 3 ft (0.9 m) in width. Aisles of travel may be designated by painted lines similar to those used in industry. Non-skid surfaces such as sand on shellac should be applied to the floor in the area around machines to minimize danger of slipping.

A 6 ft (1.8 m) x 6 ft (1.8 m) area should be planned for welding booths. The process power source should not be contained in the booth area. Welding booths shall be constructed of fire-resistant material, with the walls open at least 12 in. (305 mm) at the bottom to permit air circulation. All four sides of the welding booth should provide complete protection to the welding personnel and others in the area from harmful rays and hot sparks. A minimum of one 10 ft (3.1 m) x 10 ft (3.1 m) demonstration area should be available for every 20 welding personnel. Positioning jigs, independent of other activities to prevent congestion, should be provided.

Tools and supplies should be located as near to work areas as practical and reduce travel and interferences. Machines should be placed to allow for eases of cleaning around the base. Cabinets should fit flush to walls or be trimmed to fit flush for the same reason. Bases for cabinets and benches should provide toe space for comfort and safety of workers.

C1.3.4 Office(s). The entrance to the instructor's office should be easily accessible from the classroom, laboratory and facility corridor. Activities in the classroom and laboratory should be visible from the office. The office window space should be designed to provide maximum vision to all areas along with proper ultra violet light protection. The office ought to provide at least 120 ft^2 (11.2 m^2) of floor space per instructor [size 10 ft (3.1 m) x 12 ft (3.7 m)]. The office needs to be planned with at least one 3 ft (0.9 m) wide door, tile or carpet flooring cover, and an acoustical ceiling with fluorescent lighting. For instructional use and laboratory safety the office should have a telephone. It should also have room for file cabinets, desks, bench with storage underneath for weld supplies, a shelf for boots, and room for two chairs for counseling welding personnel.

C1.3.5 Storage. Decentralized storage should help conserve space and increase efficiency by reducing individual traffic. A storage area for bar stock should be at least 20 ft long (6.1 m) and 7 ft wide (2.1 m), with a door centered at both ends. This permits both economical purchase of steel in long lengths and wall storage within the room. Use of horizontal or vertical racks depends on space limitations and personal preference. Storage of bulk supplies (adequately secured) should be located adjacent to an outside service door for convenient delivery.

Adequate filler metal storage should be considered and should be controlled. Rod, wire, and fluxes, depending on their nature, should be maintained under certain storage conditions. The materials of higher value or requiring temperature control should require the tighter controls to ensure that product quality is retained. Acquisition of a specially designed electrode storage oven is highly recommended.

Open tool cabinets in each process are should conserve welding personnel time and travel while helping them associate proper tool selection and application with a particular activity. This also provides fore easy checking of tools. Space underneath benches and tables is excellent for storage of hardware, small amounts of raw stock or even small projects. Storage for projects of welding personnel and personal belongings is always a problem and should be well thought out.

Cylinder storage should be located near the laboratory, but accessible to truck traffic. All volatile materials should be stored outside in an identified, isolated area to minimize the potential hazards involve. Cylinder storage **shall** follow the guidelines set forth in ANSI Z49.1, *Part II—Specific Processes, 10.8.2 Cylinder Storage.*

One door should open directly to the outside from this room so that stock may be loaded into the room with no interference to shop activities. Scrap storage should be located near this entrance.

Thus, material storage areas or rooms should be located conveniently for issuing materials to the welding personnel, for cutting large stock to project size and for the unloading of delivery trucks.

C1.3.6 Personal Services and Changing Facilities. Personal Services should be planned into the laboratory, both for convenience and efficiency. Individual lockers for books and clothing should be near the entrance to keep these items out of the main instructional area. A wash-up sink and water fountain and, where possible, lavatory for each gender should also be included near the entrance.

Hot and cold running water, with suitable drinking fountains in the laboratory, and convenient sanitary restroom are necessities. Washing facilities of either the half round or trough type sink are essential and, as a rule of thumb, should be adequate to accommodate one quarter of the welding personnel simultaneously. Location of the washing facilities should be as near the door as feasible. Drinking fountains are highly desirable and should be available within the welding facility. A safety shower and eye wash station should also be located within each laboratory area. Proper drainage should be considered during installation.

C1.3.7 Lighting. One hundred (100) foot-candles (100 candela) is recommended for general work in any shop while 140 foot-candles (140 candela) would be recommended for more difficult or inspection work. In most cases, the use of indirect lighting to avoid glare and evenly diffuse the light is recommended. When needed, individual machines can be lighted by lamp attachments or through their own built-in light systems. Providing uniform distribution of shadow-free light through the use of indirect or semi-indirect deflectors should also be considered. Adequate lighting shall be provided in each booth.

C1.3.8 Electricity. Electrical power should be supplied with adequate voltage and amperage for each power source. Electrical service should be 208 volt, 230/240 volt, or 460/480 volt, single-phase or three phase, and 60/50 cycle (60/50 Hz), alternating current. The primary service should never be less than 208 volts. Current capacity of 75% more than the known demand should be provided for expansion in the welding facility. Electrical outlets for 110/120 volt service should be placed at convenient locations every 12 ft (3.7 m) and in every booth. Ground fault interrupters should be provided throughout the shop. The use of magnetic starters on all equipment is an additional safety feature which gives a machine motor overload protection as well as low voltage, and no-voltage protection. After a power failure has been corrected, the machine will not start (even if it was running when the failure occurred) until the operator presses the start button.

A disconnect switch that can be locked out, shall be provided to cut off all power equipment, including power sources, in the shop. Panic switches should be strategically located around the entire shop or laboratory and their locations known by all welding personnel. They should be wired to cut off power to every machine. Fused disconnect switches should be provided for each power source and there should be not exposed wiring.

C1.3.9 Ventilation . Individual, movable point of source exhaust pickup systems are preferred to booth hood exhaust systems. Welding station exhausts should be separate from other laboratory exhaust systems. The minimum required air velocity at the zone of welding is 100 ft/min (0.5 m/sec) when the pickup is at its farthest position from the joint being welded. The pickup size and farthest position could be reduced to lower the required capacity of the exhaust system. The use of a qualified heating, ventilation, and air conditioning (HVAC) contractor is highly recommended for design, installation, and maintenance of the exhaust system. Fire resistant, translucent, strip curtains could be lowered to form a booth when greater exhaust efficiency is desired at the demonstration area.

Exhaust systems may ventilate the exhaust from the room. However, the loss of heat during the cold months is a serious objection to room ventilation exhaust systems unless a heated makeup air intake system is used. In the hot months for an air conditioned facility, a cooled makeup air intake system needs to be used. To avoid this energy loss, cartridge (preferred) or electronic precipitator filtration, which cleans the exhausted air and reintroduces it back into the laboratory to save heated or air conditioned air, should be used. These units need careful placement to properly exhaust welding fumes from a welding laboratory.

C1.3.10 Heating. Heating and cooling capacity shall take into consideration the provision of a supply of fresh, clean incoming air. The laboratory heating system should automatically maintain a temperature of 68°F (20°C) measured 60 in. (1.5 m) above the floor. The classroom and the office should be kept at 70°F (21°C) measured 30 in. (762 mm) above the floor. A system of even heat distribution should be kept within 5% of these temperatures for health reasons and for stability of equipment and stored materials.

C1.3.11 Safety. Information regarding safety can be found in ANSI Z49.1, and additional applicable AWS Safety Standards in Annex F, Reference Materials, Safety, as well as all other applicable local, state and federal regulations. Equipment shall conform to the OSHA requirements for "lockout and tagout."

All safety features of the primary structure(s) and its support system(s) shall conform to any local, state, or federal governing codes. The school shall be able to pass an inspection of the local and state Fire Marshal and possess a certificate of conformance from the regional OSHA engineer.

C2. Instructional Equipment and Supplies

C2.1 Public School Systems. The training organization shall meet the requirements established by the School Facilities Commission for the state in which the school is located. The school's advisory committee should review these requirements and make recommendations for adjustments to instructional equipment and supplies. If the School Facilities Commission does not have requirements for instructional equipment and supplies, the advisory committee should make recommendations for instructional equipment and supplies using C2.3.1-C2.3.5 for guidance.

C2.2 Other Training Organizations—Private/Industrial. A training organization may choose to meet the requirements established by the School Facilities Commission for the state in which the school is located.

C2.3 Other Training Organizations—Private/Industrial. A training organization not using the requirements established by the School Facilities Commission for the state in which the school is located should combine the recommendations of their advisory committee and the following guide in establishing their School Welding Facilities.

C2.3.1 Welding/Cutting. The total number of welding work stations should exceed the number of welding personnel enrolled. Ideally, there should be 25% more welding stations than there are welding personnel, in order to provide for expansion of enrollment. Most of the stations

C2.3 Other Training Organizations—Private/Industrial. A training organization not using the requirements established by the School Facilities Commission for the state in which the school is located should combine the recommendations of their advisory committee and the following guide in establishing their School Welding Facilities.

C2.3.1 Welding/Cutting. The total number of welding work stations should exceed the number of welding personnel enrolled. Ideally, there should be 25% more welding stations than there are welding personnel, in order to provide for expansion of enrollment. Most of the stations should be equipped with multi-process power sources. Since SMAW is the most popular welding process, it and at least one other joining process should be linked together.

C2.3.2 Arc Welding. At least thirteen (13) multi-process constant current/constant voltage power sources for SMAW, GMAW, GTAW, and FCAW, and thirteen (13) constant current AC/DC power sources with high frequency for GTAW should be provided for every 20 welding personnel. Local industry and adult extension classes may dictate modifications to this structure.

Power sources for SMAW, and GTAW should have minimum rated output of 60% duty cycle at 175 amperes. Power sources for GMAW and FCAW should have a minimum rated output of 100% duty cycle at 175 amperes. Power sources shall be installed in accordance with the National Electrical Code, and be equipped with work leads, electrode holders, guns and/or torches.

An engine driven welder (1) per school should be adequate with both constant current and constant voltage output. Minimum rated welding output should be 200 amps cc/cv at 60% duty cycle. The fuel supply can be gasoline, diesel or propane.

C2.2.3 Oxyfuel Gas Cutting and Welding. Five (5) oxyfuel gas cutting/heating/welding torches should be provided for every 20 welding personnel. It is recommended that one (1) oxyfuel gas cutting machine be made available for demonstration and instruction. All oxyfuel gas equipment should be of industrial quality and should be appropriate for the thickness of the material being utilized in the instruction program. A distribution system for piping gases to work stations is recommended, along with one (1) portable cylinder set up per 20 welding personnel. This will facilitate instruction in safely setting up and changing compressed gas cylinders. Flashback arresters shall be provided.

C2.3.4 Plasma Arc Cutting (PAC). Two (2) plasma arc cutting machines should be provided for every 20 welding personnel. Equipment that utilizes compressed air is recommended for cutting. Plasma arc gouging is also a recommended feature. Optional compressed gases can be available, but are not a mandatory part of the cutting package. The plasma arc power source and torch should be rated to cut a minimum of 1/2 in. (12.7 mm) carbon steel at 10 in. (254 mm) per minute travel speed.

C2.2.5 Air Carbon Arc Cutting (CAC-A). Two (2) cutting/gouging torch should be provided for every 20 welding personnel. CAC-A equipment uses compressed air for either cutting or gouging. The torch and machine should be rated to cut/gouge a minimum of 1 in. (25.4 mm) carbon steel at 10 in. (254 mm) per minute travel speed. The CAC-A power source should have a minimum rated output of 60% duty cycle at 300 amperes.

Annex D

Recommendations for Personal and Shop: Materials, Equipment, and Tools

D1. Public School Systems

The training organization shall meet the requirements established by the School Facilities Commission for the state in which the school is located. The school's advisory committee should review these requirements and make recommendations for adjustments to personal and shop materials, equipment and tools. If the School Facilities Commission does not have requirements for personal and shop materials, equipment and tools, the advisory committee should make recommendations for personal and shop materials, equipment and tools using the following listing of recommendations for personal and shop materials, equipment and tools for guidance.

D2. Other Training Organizations—Private/Industrial

May choose to meet the requirements established by the School Facilities Commission for the state in which the school is located.

D3. Other Training Organizations—Private/Industrial

Not using the requirements established by the School Facilities Commission for the state in which the school is located should combine the recommendations of their advisory committee and the following guide in establishing the Personal and Shop Materials, Equipment and Tools for their Welding Facilities.

D4. Recommendations for Personal and Shop Material, Equipment, and Tools

D4.1 Personal Protective Clothing and Equipment

- suitable fire-resistant work clothing (to match service conditions for welding process employed)
- leather welding jacket, cape, sleeves or apron (optional)
- leather welding gloves clothing (to match service conditions for welding process employed)
- hightop leather safety shoes or boots (steel toed are recommended)
- welders hat or skullcap

- safety glasses or prescription glasses with side shields (clear lens)
- burning goggles or face shield (OFC & PAC)
- 2 ea. #5 filter plate
- 2 ea. #7 filter plate
- 4 ea. clear cover plate
- hearing protection (ear plugs)
- welding helmet
- welding filter plates (to match amperage and welding process employed) and clear cover plates

D4.2 Personal Tools

- carbon steel wire brush
- stainless steel wire brush
- 16 ounce ball peen hammer
- soap stone
- center punch
- metal scribe
- steel dividers (radius maker, min. 6 in.)
- handheld calculator
- measuring devices
- steal tape measure (minimum 10 in.)
- combination square set
- english/metric steel bench rule (min. 12 in.)
- chipping hammer
- 10 in. mill file (half round-bastard cut)
- cold chisel (size optional)
- pliers, wrenches and clamps
- 12 in. adjustable wrench
- tank wrench (optional)
- 10 in. groove or slip joint pliers
- 6 in. side or diagonal cutting pliers
- 6 in. needle nosed pliers

- 10 in. vice grips 10 in. vice grip clamp
- allen or hex wrench set (to 3/8 in.)
- screwdrivers
- flat head
- phillips head
- oxyfuel friction lighter, flints and tip cleaners
- flashlight
- fillet gage

D4.3 Shop Equipment and Tools

- first aid kit
- eye wash station
- chemical shower
- fire extinguisher
- bench vice (medium duty)
- 4 each 8 in. c-clamps
- grinders (2 each) and accessories
- 4 in., 4-1/2 in. or 5 in. right angle grinder
- 7 in./9 in. right angle grinder
- 25 each grinding wheels (general purpose and aluminum)
- needle gun or scaler
- 1 set adjustable wrenches
- 1 set allen or hex wrenches (to 3/8 in.)
- 1 set screwdrivers (flat and phillips head)
- 1 set vice grips
- steel topped layout or work bench (4 ft x 8 ft x 31 in. recommended)
- oxyfuel burning table with dross pan and replacement slats (4 ft x 8 ft x 31 in. recommended)
- work area protective screens (as required)
- ventilation equipment
- electrode oven
- guided bend test jig or machine

- compressed air supply and accessories (minimum delivery 80 psi @ 8 cfm per station)
- ..1/2 in. compressed air hose (length optional) compressed air regulator (to match system out-put)
- M/F quick couples and adaptors (to accommodate pneumatic tools or air carbon arc cutting torch
- hose repair kit with crimping tool

D4.4 Arc Welding/Cutting Power Source(s) and Accessories

NOTE: Selection of a single multipurpose power source able to meet all welding needs with respect to process, method of metal transfer and materials is limited. Given this limitation, a combination of power sources may be necessary to meet entry level welder training needs.

D4.4.1 Shielded Metal Arc Welding (minimum rating—AC/DC—constant current (CC) 175 amp @ 60% duty cycle)

- 25 ft 2/0 electrode cable
- 25 ft 2/0 workpiece cable
- 2/0 cable lugs and connects (to suit)
- ground clamp (amp capacity to suit)
- electrode holder (to 3/16 in. capacity)

D4.4.2 Gas Tungsten Arc Welding (minimum rating—AC/DC—constant current (CC) 175 amp @ 60% duty cycle)

- high frequency control
- gas purge control (optional)
- remote control (optional)
- water circulation and control (optional)
- torch (25 ft, amps and cooling to suit) accessory kit (to suit)
- part repair/replacement kit (to suit)
- flow meter(s) (argon, helium service)

D4.4.3 Air Carbon Arc Cutting (minimum rating—AC/DC—constant current (CC) 300 amp @ 60%)

- 25 ft 2/0 electrode cable
- 25 ft 2/0 workpiece cable
- 2/0 cable lugs and connects (to suit)
- ground clamp (amp capacity to suit)
- torch (light-medium duty)

D4.4.4 Gas Metal Arc Welding (Spray and Short Circuit) (minimum rating—DC—constant voltage (CV or CP) 175 amp @ 100% duty cycle)

- 25 ft2/0 electrode cable
- 25 ft2/0 workpiece cable
- 2/0 cable lugs and connects (to suit)
- ground clamp (amp capacity to suit)
- wire feeder (to suit power supply and wire diameter)
- gun (15 ft, amp and cooling to suit)
- consumable parts kit (0.030-0.045)
- parts repair/replacement kit (to suit)
- flow meter(s) (CO_2 or mixtures Argon/Oxygen, Argon/CO_2)

D4.4.5 Flux Cored Arc Welding (minimum rating—DC—constant voltage (CV or CP) 175 amp @ 100%)

- 25 ft 2/0 electrode cable
- 25 ft 2/0 workpiece cable
- 2/0 cable lugs and connects (to suit)
- ground clamp (amp capacity to suit)
- wire feeder (to suit power supply and wire diameter)
- self-shielded gun (15 ft, amp and cooling to suit)
- gas shielded gun (15 ft, amp and cooling to suit)
- consumable parts kit
- parts repair/replacement kit (to suit)
- flow meter(s) (CO_2 or mixtures Argon/CO_2)

D4.4.6 Plasma Arc Cutting (minimum rating—1/2 in. cut at 10 inches per minute on carbon steel)

- torch (25 ft low volt, air primary and secondary)
- consumable parts kit (to suit)
- parts repair/replacement kit (to suit)
- air regulator (to suit)

D4.4.7 Manual Oxyfuel Gas Cutting

- cutting torch (manual or combination assembly)
- oxygen regulator (to suit system)
- fuel gas regulator (to suit system)

- 25 ft oxyfuel gas hose
- 4 each (per unit) 00-3/0 cutting tips
- 4 each (per unit) 2/0 gouging tips
- 1 each (per unit) heating tip (optional)
- consumable parts kit
- parts repair/replacement kit (to suit)
- cylinder cart
- tank wrench
- friction lighter, flints and tip cleaner

D4.4.8 Machine Oxyfuel Gas

- cutting machine torch assembly (to suit)
- drive unit (track burner)
- rails or track
- oxygen regulator (to suit supply)
- fuel gas regulator (to suit supply)
- 25 ft oxyfuel gas hose
- 2 each (per unit) 00-2/0 cutting tips
- consumable parts kit
- parts repair/replacement kit (to suit)
- tank wrench
- friction lighter, flints and tip cleaner

D4.4.9 Oxyfuel Gas Supply

- oxygen supply (capacity to suit)
- fuel gas supply (capacity and type to suit)

D4.5 Fabrication Equipment (optional)

- shear 1/4 in. capacity
- ironworker
- pedestal grinder
- band saw
- drill press
- crane (A-frame)

- cage, cylinder storage
- tool room, secure storage

D4.6 Materials

- drawings or sketches
- base metal
- 3/8 in. plain carbon steel plate
- 10—14 gage plain carbon steel sheet (gage size optional)
- 10—14 gage stainless steel sheet (gage size optional)
- 10—14 gage aluminum sheet (gage size optional)
- useable pieces of all types material (thickness optional)

D4.6.1 SMAW Filler Metal

- 100# 3/32 in. E7018

D4.6.2 GMAW Filler Metal and Shielding Gas

- 14# spool (per unit) 0.035 in. E70-SX
- 14# spool (per unit) 0.045 in. E70-SX
- 75% argon + 25% CO_2 (capacity to suit) or CO_2 (capacity to suit)
- argon + 2-5% O_2 (capacity to suit)
- anti-spatter spray or gel

D4.6.3 FCAW Filler Metal and Shielding Gas

- 14# spool (per unit) 0.045 in. E71T-1
- 14# spool (per unit) 1/16 in. E71T-1
- 14# spool (per unit) 0.045 in. E71T-11
- 14# spool (per unit) 1/16 in. E71T-11
- CO_2 (capacity to suit) or 75% argon +25% CO_2 (capacity to suit)

D4.6.4 GTAW Electrodes, Filler Metal, and Shielding Gas

- 4 packages at 10 pieces each 1/16 in. EWLa-2
- 4 packages at 10 pieces each 3/32 in. EWLa-2
- 4 packages at 10 pieces each 1/8 in. EWLa-2
- 4 packages at 10 pieces each 1/16 in. EWCe-2
- 4 packages at 10 pieces each 3/32 in. EWCe-2
- 4 packages at 10 pieces each 1/8 in. EWCe-2

- 4 packages at 10 pieces each 1/16 in. EWP
- 4 packages at 10 pieces each 3/32 in. EWP
- 4 packages at 10 pieces each 1/8 in. EWP
- 4 packages at 10 pieces each 1/16 in. EWZr
- 4 packages at 10 pieces each 3/32 in. EWZr
- 4 packages at 10 pieces each 1/8 in. EWZr
- 40# 1/16 in. ER70-S2 (carbon steel rod)
- 40# 3/32 in. ER70-S2 (carbon steel rod)
- 40# 1/16 in. ER4043 (aluminum rod)
- 40# 3/32 in. ER4043 (aluminum rod)
- 40# 1/16 in. ER3XX (stainless rod)
- 40# 3/32 in. ER3XX (stainless rod)
- 100% argon (capacity to suit)
- CAC-A electrodes
- 100# 5/32 in. E7018
- 100# 1/8 in. E6010
- 100# 5/32 in. E6010
- 100# 1/8 in. E6011
- 100# 5/32 in. E6011
- 4 boxes 1/8 in. DC copper clad, pointed
- 4 boxes 5/32 in. DC copper clad, pointed
- 4 boxes 1/4 in. DC copper clad, pointed
- 4 boxes 3/8 in. DC copper clad, flat

CTE Program Audit

Requested District Data for 2 years for High School and Junior High School CTE Programs

- PEIMS Reports
    - Program Specific
        - CTE Student Enrollment
        - CTE Student Participation Codes
- CTE Budgets and Expenditure Reports (Fund 22)
    - 199-Local
    - 244-Perkins
    - 243-Tech Prep
    - CTE Teacher Salaries/Payroll Costs with Percentages
- Master Schedules
    - Class Counts
    - CTE Teacher Assignments
    - Technology Application Courses and Teacher of Record
- Course Catalogs
- Sample of Student Career Pathways/ 4 year plans

CTE Teacher Interview Questions

- What do you teach and tell me about your program?
- Tell me about your CTSO's.
- Let's look at your shop/classroom.
- Do you have adequate and updated equipment and curriculum?
- Does your program lead to any licenses or certifications for your students?
- Do you offer and teach tech prep articulated or dual credit courses?
- Where is your program headed/program goals?
- Tell me about your safety practices in the shop/lab.
- Is there anything else that you would like to tell us about your program?

Counselor/Administrator Interview Questions

- What is your philosophy of CTE in your district?
- What types of students are enrolled in your CTE classes?
- How does your district develop and allocate the CTE budgets?

- Show me a copy of your career pathways.
- What does your district do for career interest, awareness and planning?
- What does your district hope to gain or accomplish from this audit?

CTE Facility Walkthrough

- Size, scope, and layout
- Safety
- Technology
- Equipment
- Curriculum
- Supplies and Materials
- Storage
- Overall Appearance and Cleanliness
- Additional facilities such as greenhouses, animal science labs, aquaculture, arenas, and school farms.


Administrative Processes

Program Evaluation Question Stems

Administrative Processes:

- Requirements & Guidelines
    - Does the LEA have a clearly stated mission for CTE that is consistent with the state plan for CTE?
    - Was public notice of nondiscrimination in CTE programs issued prior to the beginning of school?
    - Was a statement of nondiscrimination is included on all publications and other materials distributed or accessible by students, parents, employees, and applicants?
    - Is the LEA is offering coherent sequences of CTE courses selected from at least 3 of the 16 Career Clusters? What coherent sequences are offered?
    - Is an inventory of all equipment purchased with local (state) and federal CTE funds is maintained and updated yearly?
    - Is the CTE program is open to all students regardless of race, gender, ethnicity, religion, or disability?
    - Is a process is in place to evaluate CTE programs on an annual basis?
    - Are counselors and administrators are familiar with instructional time required as documented in the Student Attendance Accounting Handbook?
    - Are CTE programs are monitored to ensure all students have universal access to all programs?
    - Describe the administration of the CTE program structure in the school district.
    - Does the district administration understand and comply with legislation and statutory requirements for Program Access Review?
    - Is a 4 year plan developed for each student enrolled in the district's Career and Technical Education program?
    - In what ways are Career and Technical Education programs evaluated on a yearly basis?
    - Which individuals are involved in the yearly program evaluation?
    - In what ways is the evaluation of your CTE programs integrated into your campus/district plan?
    - Are CTE teachers involved in ARD meetings as required?
    - What is the process for replacing and updating instructional materials?
    - Are training plans on file for each student in a career preparation/practicum course?
    - Is appropriate documentation maintained to indicate that the instructor was actively involved with the career preparation experience?
    - How are required visits and papers documented for students enrolled in a Career Preparation or Practicum course?
- Budgeting/Funding
    - Is a CTE financial plan that includes the role of all revenue streams is in place?
    - Are CTE needs to support student achievement are reflected in the school/district budget?
    - How are federal funds (Perkins) used to strengthen the academic, career and technical skills of CTE students?
    - What did CTE generated funds purchase this school year?
    - Are the quantity and quality of equipment adequate to support the independent study needs of the largest class of students?
    - Is there an established budget for the program that is being used to purchase equipment and supplies that represent those used in the industry?
    - Are there procedures and sufficient funds available for replacement and/or immediate repair of malfunctioning trainers, equipment, and/or tools?
    - Is all equipment placed on a rotating replacement plan?
    - Are the size of the facility and number of training stations adequate to ensure safety and quality education and training in relation to the program's objectives?
- Planning & Scheduling

Program Evaluation Question Stems

- Is it documented that CTE courses entered on the master schedule correspond with those indicated in district cluster planning documents?
- How often do counselors receive training related to the development and continuance of existing local CTE clusters?
- How is it shown that counselors are given course sequences and understand the importance of incorporating CTE courses and course sequences into students' class schedules?
- Are all CTE courses are part of a course sequence leading to postsecondary education, industry certification, and/or skill employment?
- Are classes scheduled to avoid conflicts with other courses students need for graduation?
- Are informative materials/meetings used to enlighten educators, parents, students, business and industry, and the general public concerning the CTE program?
- Is a sound public relations program being conducted in the school and community (radio, TV, news stories, brochures, civic appearances, etc.)?
- Which individuals at your school/district are involved with assessment, feedback, and parent sessions?
- Does your district utilize career assessment results to develop student career pathway or 4 yr plans?
- Does your district utilize career assessment results to develop CTE programs' yearly evaluation?
- Does your district utilize career assessment results to develop new programs/pathways and articulations?
- Does your district utilize career assessment results to develop the district/campus plan?
- Are 4 year plans updated with the student each year?
- What were the demographics of CTE students for this school year?
- Are program courses offered in a logical sequence utilizing prerequisite courses as necessary?
- Have career pathways offered been identified and can they be found on a chart or diagram available to the students?
- Does the school master schedule allows students to follow the recommended sequence of CTE courses to complete the selected career path?
- Do students enter high school with a completed program of study?
- Are all course enrollment decisions are based on the students' interest surveys and program of study plans?
- Does the CTE staff meet for regularly scheduled monthly meetings?
- Do all PBM Indicators meet or exceed the state level targets?

- Are End of Course Surveys conducted:
  - For Parents: (sample questions/topics)
    - The units of study in this course enabled my child to learn new skills and information.
    - The teacher presented the units of study in a manner that my child was able to understand.
    - The assignments and activities enabled my child to better learn and understand the material.
    - The teacher allowed adequate time to cover the units of study in this course.
    - The class textbook and/or resource materials used in the class were appropriate and helpful to my child.
    - The units of study covered in this course were the ones I expected to be covered.
    - I would recommend this course for other students to take.
    - What did your child like most about this course?
    - What recommendations do you suggest to improve this course?
  - For Students: (sample questions/topics)
    - The course objectives were clear.
    - The course workload was manageable.
    - The course was well organized (e.g. timely access to materials, notification of changes, student expectations clearly presented, etc.)
    - Approximate level of your own attendance during the course.

Program Evaluation Question Stems

- I participated actively in the course
- I think I have made progress in this course
- I think the course was well structured to achieve the learning outcomes (there was a good balance of lectures, labs, etc.)
- The learning and teaching methods encouraged participation.
- The overall environment in the class was conducive to learning.
- Classrooms were satisfactory and had all needed supplies.
- Learning materials (Lesson Plans, Course Notes, etc.) were relevant and useful.
- Recommended reading was relevant and appropriate
- The provision of learning resources (equipment, tools) was adequate and appropriate
- Learning resources were varied (books, online, etc) and useful.
- The course stimulated my interest and thought on the subject area
- The pace of the course was appropriate
- Ideas and concepts were presented clearly
- The methods of assessment were reasonable
- Feedback on assessment was timely
- Feedback on assessment was helpful
- The material was well organized and presented
- The instructor was responsive to student needs and problems
- Was the instructor consistent throughout the course?

o For Teachers: (sample questions/topics)

- My classes are held at times and in locations that are convenient for most of our students.
- Administrators are knowledgeable of the school and CTE curriculum.
- I am involved in the school's planning and continuous improvement of career and technical education programs under the Carl D. Perkins grant.
- There is an established school advisory committee that works with my subject area.
- I am provided opportunities to attend professional development activities in my subject area that includes visiting business and industry related to my program area.
- Frequent communication occurs between faculty and administration.
- I would like to have more training in differentiated teaching strategies.
- I have been provided with training opportunities to fully utilize the latest technology for my program area.
- School counselors have knowledge about career and technical education courses in my school.
- Students are encouraged to take career and technical education courses by school counselors.
- Important occupational trends are considered in curriculum and course planning.
- The Career and Technical Education plan is revised, monitored, and reviewed periodically.
- An atmosphere of respect and trust exists between staff and administration, teachers, and students.
- Available resources appropriate for students enable me to use a variety of teaching methods.
- My classroom is equipped with current technology for my subject area.
- The current "traditional" schedule is currently meeting the needs of the student population and programs.
- Appropriate safety principles are taught and practiced.
- Extracurricular and supplemental activities support instruction.
- School conduct rules and procedures are taught along with other skills.
- TAKS objectives are supported by CTE instruction.
- CTE electives are integrated into the school curriculum.
- The curriculum is varied to accommodate needs, interests, and abilities of students.
- My class goals are consistent with school and district goals.

Program Evaluation Question Stems

- Assessment data are used to improve the CTE programs.
- Student performance is monitored in a variety of ways.
- Effective and frequent communication occurs with parents.
- Community resources are used to support the CTE programs.
- Parents actively participate in school-sponsored CTE activities.

SREB

HIGH SCHOOLS THAT WORK

Technical Assistance Visits: A Guide for Local Sites

SPRING 2009

Southern
Regional
Education
Board

592 10th St. N.W.
Atlanta, GA 30318
(404) 875-9211
www.sreb.org

Classroom Observation Form

Observation Time: Opening _____ Middle _____ Closing _____

Course/Level: _____ Class Size _____ Male _____ Female _____

Ethnicity:

White	Black	Hispanic	Asian American	Native American	Other
_____	_____	_____	_____	_____	_____

CLASSROOM OBSERVATION FORM	DESCRIPTIONS/COMMENTS
Evidence of emphasis on literacy ___ Use of reading-to-learn strategies ___ Use of writing-to-learn strategies ___ Student presentations using set criteria ___ Evidence of reading both in and out of school	Describe the classroom activities or assignments requiring students to read, write and/or present.
Evidence of emphasis on numeracy ___ Use of real-world problems ___ Use of problems with many possible answers ___ Use of graphs, charts and tables	Describe classroom activities or assignments that highlight the mathematical skills associated with the lesson.
Evidence of emphasis on integration ___ Cross-curricular connections ___ Interdisciplinary unit ___ Application of skills/content learned in other classes	Describe any other integrated content observed in the lesson, including integration of content from elective courses.
Evidence of emphasis on state/national standards ___ State standard or essential questions posted ___ Learning objective posted ___ Learning outcomes described by teacher	What content standard or objective was addressed with this lesson? In your professional opinion, was the content at or above grade level?
Classroom Environment ___ Student work displayed ___ Evidence of rubrics ___ Print-rich environment ___ Availability of technology	Briefly describe the classroom environment. Describe the classroom setup (rows of desks, clusters or tables).
Teacher Actions ___ Lecture ___ Teacher-led instruction/discussion ___ Teacher modeling with student practice ___ Teacher works with individual students ___ High-level questioning	Briefly describe what the teacher was doing and the teacher's location during your time in the classroom.
Student Actions/Activities ___ Bell ringer/warm-up activity ___ Project/problem-based learning ___ Lab/hands-on student work ___ Using technology ___ Cooperative group work ___ Students working with partners ___ Students making presentations ___ Drill/worksheet/text seat work	Briefly describe what students were doing during your time in the classroom.

Summary of Observation:

RIGOR/CHALLENGE OF WORK	☐ Basic	☐ Proficient	☐ Advanced
ENGAGEMENT OF STUDENTS	☐ Low (Compliant)	☐ Medium	☐ High

Appendix V

School Administrator Interview Questions

1. What have been your major accomplishments in impacting student achievement and graduation rates? What have been your major accomplishments in implementing the *HSTW* Key Practices?

2. What major challenges do you and the school face in fully achieving the *HSTW* Goals?

3. How have you engaged the faculty in continuous improvement efforts?

   - Describe how often and how effectively your teachers work together. How often do departments hold formal meetings to review and revise the curriculum? How often do your teachers meet in interdisciplinary teams to review school improvement actions? How are these teams formed?
   - Do teachers meet to frequently review assignments, student work and assessments to determine if they expect students to learn at the Proficient level? How do you support teachers to define Proficient-level work?
   - How do teachers work together to analyze teacher-made assessments to ensure that they reflect both state standards and appropriate grade-level work?

4. What grade level or group of students have you identified as a priority at this school? Why was this group identified? What programs or activities are you implementing to address this group's needs? (Probe: ninth-grade bulge, 10th- grade dropouts, etc.)

5. Is there a program that ensures all students who have a grade below "B" have access to and receive extra help? If so, describe this program. If not, describe extra-help opportunities or the pyramid of interventions at this school.

6. How do you involve parents and students in the school improvement process?

7. How have you worked with teachers to align instruction to state standards? How do you support teachers in addressing these standards within the classroom? (Probe: development of a curriculum framework, course syllabi, analysis of student work, common end-of-course exams and units of study).

8. What actions have been implemented to address the quality of instruction across the campus? What type of staff development has been provided to improve teaching and learning? What types of follow-up activities are used to ensure that staff development topics are used in the classroom?

9. How have you worked with teachers to integrate literacy and numeracy across the curriculum?

10. How do you use data to evaluate the school's academic and career/technical programs? How do you assist your teachers in using school data?

11. What actions have you taken to create a culture of high expectations in the school?

12. What processes do your career/technical teachers use to highlight academic content in daily lessons and assessments?

Student Interview Questions

1. How would you describe your high school to a friend?
2. In which class do you learn the most and why?
3. Describe the one assignment in high school that you did your best work on, that you worked the hardest on and that you are most proud of. What factors caused you to do your best work on that assignment?
4. How do teachers communicate the amount and quality of work necessary to earn an A or B? (Probe: syllabus, scoring guides, rubrics, student work samples, etc.).
5. Are you allowed to redo your work until it meets standards? If yes, describe the process.
6. If you are struggling with the concepts in a class, describe any form of extra help that is available to you. Is it required? What opportunities do you have to make up (earn) credits if you have fallen behind? (Probe: credit recovery options).
7. How many books have you read this year in English class?
   - What type of reading assignments do you have in other classes?
   - Describe any writing assignments that you are given outside of English class.
   - How often are you required to make oral presentations? In which classes?
   - Do you have an annual research paper assignment? Describe it.
8. Describe a typical day in your mathematics and science classes.
9. Have you been assigned an adviser or mentor? If yes, describe how that mentor or adviser works with you.
10. When did you develop a career plan (five-year plan)? (A five-year plan is completed at the end of eighth grade and provides an outline of the courses that students will take throughout high school based on the student's career interest area.) How often is it reviewed? How are your parents and teachers involved in course selection and planning activities?
11. Describe what you will do after graduation. What kind of training or advanced certifications will you need to be successful in your future career?
12. Are any of you enrolled in a career/technical program?
13. Are you required to take a industry certification exam upon completion of the program (A+ Networking, Cisco, CNA, etc.)? Are you taking classes that would allow you to earn postsecondary credit while in high school? If so, which courses will allow you to do this?
14. Describe one change you would make in this school that would motivate students like you to work harder, achieve at higher levels and be more motivated to learn.

Appendix V

Ninth-Grade Student Interview Questions

1. Describe your school.
2. Do you believe you were prepared to do high school work successfully? Why or why not?
3. What do you wish your middle grades school had done differently that would have better prepared you for high school?
4. Describe any activities that you participated in to assist you in adjusting to high school (Probe: orientation, parent/student night, ninth-grade study skills class, etc.).
5. Describe your ninth-grade English and mathematics courses.
6. In which class do you learn the most and why?
7. How many books have you been assigned to read during school hours/class time? Outside school hours?
8. How do teachers communicate the amount and quality of work you will need to submit to earn an A or B? (Probe: syllabus, scoring guides, rubrics, student work samples, etc.)
9. Describe a project or activity that you completed that was graded by two or more of your teachers. Describe other challenging projects that you have completed this year.
10. Do your teachers work together? Explain why you think they do or do not.
11. If you are struggling with the concepts in a class, describe any form of extra help that is available to you. Is it required?
12. Are you required to take a support class that focuses on study skills, note-taking and time-management skills? If so, describe.
13. Have you been assigned an adviser or mentor? If yes, describe how that adviser or mentor works with you.
14. When did you develop a career plan (five-year plan)? How often is it reviewed? How are your parents and teachers involved in the career-planning process?
15. Describe one change you would make in this school that would motivate students like you to work harder, achieve at higher levels and be more motivated to learn.

Appendix V

Career/Technical Teacher Interview Questions

1. Why do you have the career/technical programs that you currently offer?
2. What data do career/technical teachers examine, and how is data used to make changes in curricula and/or instruction?
3. How are career/technical programs of study communicated to middle grades and high school students (brochure, Web site, open house, etc.)? Have middle grades and high school teachers and students toured the career/technical facilities?
4. When do most students start taking career/technical courses to support their programs of study? How many ninth-graders are currently enrolled in career/technical courses? What actions are you taking to engage students in career/technical studies upon entering high school?
5. Describe one lesson or series of lessons in which you successfully embedded academic content in an assigned project or major work-simulation task. How did you evaluate students on this assignment? How did you evaluate students' understanding of both the academic and career/technical skills needed to complete the assignment?
6. Have teachers established major course goals that specify technical and academic knowledge and skills students will acquire in career/technical courses? If so, how are goals communicated to counselors, teachers, parents and students?
7. How is technical literacy integrated into career/technical courses? How are career/technical teachers integrating reading and writing into the career/technical curriculum? What training have you had in engaging students in reading for technical fields?
8. Have career/technical courses been aligned to mathematics and science standards so that teachers are using common vocabulary? Describe the process used or any plans in place to do this.
9. Are career/technical teachers and career/technical programs certified? Describe career/technical certifications and identify student certification opportunities.
10. Are students' work-based learning experiences connected to their career goals? Are there established policies and practices for career/technical work-based learning? Explain.
11. How do career/technical programs prepare students to be successful on industry certification exams?
12. Are career/technical teachers involved in focus teams that address school improvement goals? If so, briefly describe the focus teams and efforts undertaken or planned.

Counselor Interview Questions

1. Describe how you are using *HSTW* to improve the guidance and advisement process. What specific changes have occurred in guidance and advisement as a result?
2. What major challenges do you and your school face in fully achieving the *HSTW* Goals and Key Practices?
3. Do all students have adult advisers who stay with them through all four years of high school?
   - Describe any advisory sessions.
   - What types of curricula or resources are used to support your advisory program?
4. How do you involve parents in the guidance and advisement process? Are parents required to meet with you and/or the student's adviser before class registration?
5. How does the career-planning process address students' career aspirations?
6. How does the guidance office work with administrators and teachers to increase the percentage of students who complete a challenging program of studies and the *HSTW*-recommended core)?
7. How do you use data to help plan students' programs of study? How are students encouraged to complete a concentration?
8. How many students take advantage of dual credit courses? How do you promote these options with students?
9. What resources (career pathway brochures, course catalogues, course sequence outlines, etc.) do you use to communicate expectations for completing a program? How do you work with teachers to push students to earn an industry certification (when available)?
10. How do you help students see the relationship between the courses they take and their future plans?

Appendix V

Postsecondary Representative Interview Questions

1. Describe the partnership that your campus has with this high school.
2. Which programs do students from this high school currently enroll in? Do students have an opportunity to earn credits (working with your campus) before they graduate from high school? If so, which courses provide these opportunities?
3. Describe the available opportunities for your teachers and teachers from the high school to work together to review and align curricula.
4. How many students coming from the high school are required to take remedial course work on your campus? Which remedial courses do these students typically need?
5. Describe any activities or events that expose students to programs that your campus will support after they graduate from high school.
6. How can the high school work with your campus to expand opportunities for students?

Business/Industry Representative Interview Questions

1. How would you describe a graduate from this high school to a potential employer in your career area?
2. Is there a business/steering committee in place to give the school advice on students' program and technology needs? Name activities in which the steering committee has participated over the past school year.
3. How are you helping teachers and administrators set higher standards for students?
4. How does your company recognize high achievement by students?
5. Does your company request school information such as attendance records, transcripts and student portfolios as criteria for hiring students? If so, explain.
6. Is the work experience at your business a learning experience? For example, do students learn various aspects of running a business? Do you use job rotation and have students' complete progressively more complex tasks? Do students learn to make choices by learning more about different occupations? Is there a work site mentor?
7. Do you provide mentoring and tutoring opportunities?
8. Have you had any opportunities to:
   - provide information and activities to prepare students for challenging careers?
   - partner with schools and teachers to improve student's academic and technical knowledge?

- provide educators, students and parents with specific information about the preparation needed to advance in the industry?
- provide students with quality workplace learning opportunities?

9. How often do you get to interact with students, either observing a class or making a presentation as a guest speaker?
10. How can the school better prepare students to work in your program area?

Parent Interview Questions

1. What evidence do you have that your child completes high-quality work while in high school?
2. How have you helped your child select courses to take during high school? What information is provided to assist you and your child to plan for next steps after graduation?
3. Has your child received information about high school graduation requirements and further study or work?
4. How did the high school help your child adjust to a new learning environment and campus expectations (middle grades to high school transition)?
5. What opportunities do you have to meet/talk with your child's teachers or come to the campus to see what your child is doing?
6. How often are parents required to meet with teachers or guidance counselors?
7. How do teachers and campus leaders communicate with parents? How do you learn about school-related events and opportunities? (Probe: newsletter, Web site, online grading system, etc.)?
8. Does the school emphasize a few important school rules and enforce them consistently and fairly for all students?
9. Do adults in this school communicate high expectations for all students? How? How much homework does your child typically have? Is he or she required to complete a research paper?
10. How would your child get extra help if he or she were struggling in a class?
11. Is your child required to read outside of class? How much? Give examples.
12. How does the school involve parents and students in improvement activities?
13. Give an example of a high-quality project or assignment that your child was required to complete.
14. How can teachers and school leaders improve the relationship and communication with parents?

Instructional Review Rubric

National Assessment of Educational Proficiency (NAEP) proficiency levels provide information about what students should know and be able to do within a given subject area. NAEP items that illustrate various achievement levels are selected based on probability estimates of student performance for a given item within established score-scale ranges. For the purpose of this classification exercise, assigning questions into one of three proficiency levels is based on understanding and projecting the meaning of the proficiency level descriptions, rather than through a NAEP-style statistical analysis.

Basic-level assignments and questions focus on the two lowest levels of Bloom's Taxonomy: Students recall facts; make simple inferences or interpretations; demonstrate a rudimentary understanding of terminology, principles and concepts that underlie the field; and are able to make only direct connections between content and personal experience. Basic-level work requires students to:

- identify some parts of physical and biological systems.
- recognize relationships presented in verbal, algebraic, tabular and graphical forms.
- answer who, what, where and when questions.

Assignments that require students to remember information or make simple explanations are at the Basic level.

Proficient-level assignments and questions focus on the two middle levels of Bloom's Taxonomy. Students are required to use analytical skills, draw reasonable conclusions, and make appropriate conjectures or inferences by applying logical reasoning on the basis of partial or incomplete information. Proficient-level work requires students to:

- defend ideas and give supporting examples.
- understand algebraic, statistical, and geometric and spatial reasoning that is relevant to the field.
- apply scientific and technical principles to everyday situations.
- judge and defend the reasonableness of answers or solutions to problems that routinely occur in their chosen technical field.

Proficient-level questions and assignments require students to apply and analyze information learned.

Advanced-level assignments and questions focus on the two highest levels of Bloom's Taxonomy. Students formulate generalizations, synthesize ideas and create models through probing examples and counterexamples. Advanced-level work requires students to:

- communicate their ideas and reasoning through the correct use of concepts, symbolism and logical thinking.
- design and apply procedures to test or solve complex, real-world situations.
- develop thorough, thoughtful and extensive written responses.

Advanced-level questions and assignments require students to evaluate and create work.

The attached rubric provides leaders with each of the following:

- The three NAEP levels
- The old and new Bloom's Taxonomy levels
- Sample verbs used for that level of questions
- Sample question stems
- Potential assignments

Leaders should not consider this an all inclusive group and will have to make judgments as to the appropriate level based on examples provided.

Appendix VI

Instructional Review Rubric

Basic

Knowledge	Comprehension
Remembering	Explaining

Useful Verbs		Useful Verbs	
tell	write	explain	predict
list	find	interpret	restate
describe	state	outline	translate
relate	name	discuss	compare
locate		distinguish	describe

Sample Question Stems For Assessments	Sample Question Stems For Assessments
What happened after…?	Write in your own words…
How many…?	Write a brief outline…
Who was it that…?	What do you think could have happened next?
Name the…	Who do you think…?
Describe what happened at…	What was the main idea?
Who spoke to…?	Who was the main character?
Tell me why…	Distinguish between…
Find the meaning of…	What differences exist between…?
What is it…? Which is true or false…?	Provide an example of what you mean by…
	Provide a definition for…

Potential Assignments And Products

- List the story's main events
- Make timeline of events
- Make a facts chart
- List any pieces of information you can remember
- Recite a poem
- List all the animals in the story
- Make a chart showing…
- Remember an idea or fact
- Question and answer sessions
- Workbooks and worksheets
- Remember things read, heard, seen
- Information searches
- Reading assignments
- Drill and practice
- Finding definitions
- Memory games quizzes
- Forming relationships (analogies, similes)
- Predicting effects of changes
- Dramatization
- Peer teaching
- Show and tell
- Estimating
- Story problems
- Cut out or draw pictures to show a particular event
- Illustrate the main idea
- Make a cartoon strip showing the sequence of events
- Write and perform a play based on the story
- Retell the story in your own words
- Paint a picture of some aspect of the story you like
- Write a summary of the event
- Prepare a flow chart to illustrate the sequence of events

Instructional Review Rubric

Proficient

Application

Applying

Useful Verbs

solve	construct
show	complete
use	examine
illustrate	classify
calculate	

Sample Question Stems For Assessments

Do you know another instance where…?
Could this have happened in…?
Group by characteristics such as…
What factors would change if…?
Apply the method used to some experience of your own…
What questions would you ask of…?
From the information given, develop a set of instructions about…
Would this information be useful if you had a…?
Which event could not have happened if…?
If…happened, what might the ending have been?
How was this similar to…?

Comprehension

Explaining

Useful Verbs

analyze	categorize
distinguish	identify
examine	explain
compare	separate
contrast	advertise
investigate	

Sample Question Stems For Assessments

What was the underlying theme of…?
What do you see as other possible outcomes?
Why did…changes occur?
Compare your…with that presented in…
What must have happened when…?
How is…similar to…?
What are some of the problems of…?
What was the turning point in the story?
What was the problem with…?

Potential Assignments And Products

- Construct a model to demonstrate how it will work
- Make a diorama to illustrate an important event
- Compose a book about…
- Make a scrapbook about the areas of study
- Make a papier-mâché map showing information
- Make a puzzle game using ideas from the study area
- Make a clay model of…
- Paint a mural
- Design a market strategy for your product
- Design an ethnic costume
- Use knowledge from various areas to find solutions
- Role playing/role reversal
- Producing a newspaper, stories, etc.
- Interviews
- Experiments
- Solving problems by use of known information
- Practical applications of learned knowledge
- Suggest actual uses of ideas
- Design a questionnaire to gather information
- Make a flow chart to show critical stages
- Write a commercial for a new or familiar product
- Review a work of art in terms of form, color and texture
- Construct a graph to illustrate selected information
- Uncover unique characteristics
- Distinguish between facts and inferences
- Evaluate the relevancy of data
- Recognize logical fallacies in reasoning
- Recognize unstated assumptions
- Analyze the structure of a work of art, music or writing
- Compare and contrast
- Attribute listing
- Construct a jigsaw puzzle
- Analyze a family tree showing relationships

Instructional Review Rubric

Advanced

Synthesis	Evaluation
Create	Evaluate

Useful Verbs		Useful Verbs	
create	design	design	verify
invent	imagine	imagine	argue
compose	improve	improve	discuss
predict	propose	propose	determine
plan	devise	devise	prioritize
construct	formulate	formulate	

Sample Question Stems For Assessments	Sample Question Stems For Assessments
Design a…to…	Write a new recipe for a tasty dish...
What is a possible solution to…?	Is there a better solution to…?
What would happen if…?	Judge the value of…
If you had access to all resources, how would you deal with…?	Defend your position about…
How would you design your own way to…?	Do you think…is a good or bad thing?
How many ways can you…?	Explain...
Create new and unusual uses for…	How would you have handled…?
Develop a proposal which would…	What changes to…would you recommend?
How would you compose a song about…?	Are you a…person? Why?
	How would you feel if…?
	How effective are…?

Potential Assignments And Products

- Invent a machine to do a specific task
- Design a building
- Create a new product, give it a name and plan a marketing campaign
- Write your feelings in relation to…
- Write a TV show, play, puppet show, song, or pantomime about…
- Design a record, book, or magazine cover for…
- Create a language code
- Sell an idea to a billionaire
- Compose a rhythm or put new words to a known melody
- Hypothesize
- Write a creative story, poem or song
- Propose a plan for an experiment
- Integrate the learning from different areas into a plan for solving a problem
- Formulate the new scheme for classifying objects
- Identify goals and objectives
- Show how an idea or product might be changed
- Prepare a list of criteria to judge…
- Conduct a debate about an area of special interest
- Make a booklet about five rules you value
- Make judgments about data or ideas based on either internal or external conditions or criteria
- Accept or reject ideas based on standards
- Judge the logical consistency of written material
- Judge the adequacy with which conclusions are supported with data
- Judge the value of a work of art, music or writing by using internal criteria or external standards of excellence
- Generate criteria for evaluation
- Evaluating one's own products and ideas
- Form a panel to discuss a topic and state criteria
- Write a letter advising changes needed...

Evaluating the Quality of Career/Technical Programs

Technology Centers That Work

The attached document, **Career/Technical Education — Tool for Evaluating the Quality of a CT Program,** can be used to assess the quality of a specific CT program of study at comprehensive high schools, shared-timed CT centers or full-time CT centers, including *Technology Centers That Work* (*TCTW*) sites. This self-assessment tool was designed to bring consistency and objectivity to the evaluation of a CT program of study.

The 18 quality indicators in this tool each include descriptions for progressive levels of implementation. CT teachers and school leaders can use the tool to pinpoint strengths and gaps in their CT programs and to conduct a self-assessment prior to a Technical Assistance Visit (TAV). TAV teams can use the tool to focus on strengths and challenges the school faces in creating high-quality programs of study. School improvement consultants can use it as they work with schools to improve program quality.

Use the indicator descriptions in the following pages to evaluate the quality of the CT program, based on the four levels of implementation, and record the level below. After recording the levels of implementation, identify the challenges to reaching full implementation and develop actions to overcome those challenges.

Quality Indicator	CT Program Level of Implementation				Challenges to Implementation	Actions to Overcome Challenges
1. Program of Study	☐ 1	☐ 2	☐ 3	☐ 4		
2. CT Syllabus	☐ 1	☐ 2	☐ 3	☐ 4		
3. Work-Based Learning	☐ 1	☐ 2	☐ 3	☐ 4		
4. CT Student Organizations (CTSOs)	☐ 1	☐ 2	☐ 3	☐ 4		
5. Embedded Literacy	☐ 1	☐ 2	☐ 3	☐ 4		
6. Embedded Numeracy	☐ 1	☐ 2	☐ 3	☐ 4		
7. Use of Technology	☐ 1	☐ 2	☐ 3	☐ 4		
8. Professional Development	☐ 1	☐ 2	☐ 3	☐ 4		
9. Guidance and Advisement	☐ 1	☐ 2	☐ 3	☐ 4		
10. Parental Involvement	☐ 1	☐ 2	☐ 3	☐ 4		
11. Articulation and Dual Enrollment Agreements	☐ 1	☐ 2	☐ 3	☐ 4		
12. Advisory Committee	☐ 1	☐ 2	☐ 3	☐ 4		
13. Marketing, Public Relations and Community Outreach	☐ 1	☐ 2	☐ 3	☐ 4		
14. Enrollment	☐ 1	☐ 2	☐ 3	☐ 4		
15. Retention and Completion	☐ 1	☐ 2	☐ 3	☐ 4		
16. Post Program Positive Placement	☐ 1	☐ 2	☐ 3	☐ 4		
17. State Assessment, *HSTW* Assessment and College Readiness	☐ 1	☐ 2	☐ 3	☐ 4		
18. Industry Credentialing and Technical Assessments	☐ 1	☐ 2	☐ 3	☐ 4		

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1 Little or No Development and Implementation	Level 2 Limited Development or Partial Implementation	Level 3 Operational Level of Development and Implementation	Level 4 Exemplary Level of Development and Implementation
1. Program of Study A career-focused program of study includes a sequence of college-preparatory academic courses **and** a sequence of at least four career/technical (CT) courses students would take to prepare for both further study and careers in the broad career field. It can be career theme-based or occupational-specific. The sequence of CT courses is aligned with academic standards required for high school graduation, college- and career-readiness standards required for successful transition to postsecondary education and technical standards essential to the career field.	The program of study is not aligned with state academic standards required for high school graduation. The program of study is not aligned with college- and career-readiness standards. The program of study is not aligned with current technical content standards. The program of study does not include a sequence of at least four courses to meet CT completer requirements.	The program of study is aligned to state academic standards for reading required for high school graduation. At least 40 percent of the program of study is aligned with college- and career-readiness standards for reading and mathematics. Students can have a single occupational focus without having to complete any part of the *HSTW*-recommended academic core to meet graduation requirements. At least 40 percent of the program of study is aligned with current technical content standards. There is no evidence the program of study addresses the soft skills that employers desire of employees. The program of study includes a sequence of no more than four courses.	The program of study is aligned to state academic standards for reading and mathematics required for high school graduation. At least 75 percent of the program of study is aligned with college- and career-readiness standards for reading and mathematics. At least 75 percent of the program of study is aligned with current technical content standards. The program of study addresses soft skills that employers desire of employees. The program of study requires CT students to take advanced academic or CT courses that supplement their career focus and complete at least two parts of the *HSTW*-recommended academic core.	The program of study is fully aligned with state academic standards for reading, mathematics and science required for high school graduation. The program of study is aligned with college- and career-readiness standards, and CT students complete the *HSTW*-recommended academic core for English, mathematics and science. The program of study is fully aligned with current technical content standards, and students complete at least four sequenced CT courses. Career courses are articulated to build depth of knowledge and skills without redundancy and they integrate opportunities for students to gain firsthand experience in the career field. The program of study creates a career pathway to prepare students for the transition to postsecondary education. The pathway includes a formal apprenticeship program, certificate program, a two-year degree program or a four-year degree program and is consistent with the student's career goals.

This evaluation tool, based on a program audit rubric model from Trumbull Career & Technical Center, Warren, Ohio, was developed with input from the *TCTW* Advisory Committee and *HSTW* Board.

[1] Some states define a CT completer based on a sequence of three CT courses, completion of a specified number of hours, etc. For this indicator, use the appropriate prescribed state measure for determining a CT completer.

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1	Level 2	Level 3	Level 4
2. CT Syllabus Each course in the sequence of CT courses has a syllabus that meets guidelines and includes sample exemplary assignments and projects relevant to the career field and formative and summative assessments. The examples cover the spectrum of standards: academic standards for high school graduation, college- and career-readiness standards, and industry standards.	Course syllabi do not exist for all CT courses. Existing CT course syllabi do not meet course syllabus guidelines or include necessary elements, such as: ■ course description ■ instructional philosophy ■ course goals ■ major course projects ■ project outlines ■ instructional delivery plan ■ assessment plan	At least 50 percent of the courses have a syllabus meeting the guidelines. All syllabi are designed to the level of learning needed to meet state academic standards for high school graduation.	All CT courses have a course syllabus that meets the guidelines. All syllabi are designed to the level of learning needed to meet state academic standards and technical standards. CT course descriptions indicate where courses fall within the program of study. CT syllabi contain descriptions of anchor assignments and projects for each course in the sequence. Examples of assignments, projects and assessments are designed to help students meet academic standards for high school graduation and technical standards of the career field.	All CT courses meet all requirements of Level 3, and each syllabus is aligned to the essential college- and career-readiness standards. The syllabus includes details on assessment and grading; rework policies (i.e., redoing substandard work); and standards-based assignments and project outlines using real-world problems. Examples of assignments, projects and assessments are designed to help students meet college- and career-readiness standards and technical standards for the career field. Each syllabus contains an example of an authentic project to be assessed by a panel of judges.

[2] An anchor assignment is a major activity, problem or project that is authentic, will take several days to complete and engages students as they apply literacy and numeracy skills. The anchor assignment assesses for an understanding of these skills.

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1	Level 2	Level 3	Level 4
3. Work-Based Learning Work-based learning is a formal, structured program linked to the CT program of study and approved by the school. Options include youth apprenticeships, cooperative learning, internships, job shadowing and community service.	No work-based learning opportunity is established.	Work-based learning opportunities are limited to field trips and job shadowing. There is at least one planned field trip, as well as formal job-shadowing opportunities that rotate students through a variety of work settings. The CT program does not actively solicit local businesses in the career area to provide work-based learning opportunities. Students may or may not have to report on or evaluate the experience. There is no evidence of a link between classroom assignments and work-based learning experiences.	Work-based learning opportunities include field trips, job shadowing, internships and cooperative work experiences. There is a formal training plan for internships. The school's work-based learning coordinator actively solicits local businesses to provide work-based learning opportunities for CT students to gain firsthand experience in the broad career area. No formal follow-up on work-based experience is done with employers or students. Students may or may not have to report on or evaluate the experience.	Work-based learning opportunities include field trips, job shadowing, internships, cooperative work experiences, mentorships and apprenticeships. There is a formal training plan, and the work-based learning opportunities are linked directly to school studies. There is ongoing formal communication between the school and the business providing the work-based learning to ensure quality experiences for students and employers. Students are expected to complete school assignments related to the work-site activities (e.g., maintaining daily logs of work-site activities, preparing weekly summaries, and developing a portfolio). CT leadership takes actions to resolve issues identified during follow-up.

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1	Level 2	Level 3	Level 4
4. CT Student Organizations (CTSOs) CTSOs provide students opportunities for leadership development, competitive events, professional development and community service.	There is no participation in the CTSO and no plan for increasing participation.	The CTSO is organized in name only. Students have few opportunities to enhance their occupational, employability and leadership skills or participate in service learning through the CTSO. Plans are made to increase participation.	The CTSO is an integral part of the instructional program and provides opportunities for service learning and occupational, employability and leadership development. All students participate in the CTSO or related activity. All students participate in at least one local competitive event specific to the program.	The CTSO meets all requirements of Level 3 and is highly visible and successful, as evidenced by the number of students receiving awards and recognition in local, regional, state and national competitive events. Program participants take part in regional, state and national competitive events and earn at least two awards annually if such competitive events exist for the program.
5. Embedded Literacy Each course in the CT program integrates reading and writing academic standards and strategies into all aspects of learning in the CT classroom. Assignments frequently require students to read, write and make presentations related to the CT field of study.	No evidence exists in course syllabi of anchor assignments that require reading and writing about technical content relevant to the career field. There is no evidence of literacy strategies being used in the CT classroom.	The course syllabus has one example of an anchor assignment embedded with reading and writing. Technical reading and writing are evident.	Two to three examples of anchor assignments embedded with reading and writing are found in each course syllabus. Academic and CT teachers collaborate to embed academics. CT teachers are using instructional strategies that improve students' literacy skills.	A major anchor assignment is found in every course during each grading period. Teachers embed reading readiness standards by having students summarize, paraphrase, categorize, infer, predict, use vocabulary, research and write about the technical field. Classroom assessments are administered by CT teachers to validate students' mastery of reading standards in context of career fields.

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1	Level 2	Level 3	Level 4
6. Embedded Numeracy Mathematics academic standards and numeracy strategies are incorporated into CT assignments and all aspects of learning in the CT classroom, with frequent assignments that require students to apply mathematics skills to authentic problems found in the CT field of study.	No evidence exists in course syllabi of anchor assignments that require mathematics to solve problems relevant to the career field. There is no evidence of numeracy strategies being used in the CT classroom.	The course syllabus has one example of an anchor assignment that requires mathematics skills. Teachers are using mathematics vocabulary for mathematics related to the CT course.	Two to three examples of anchor assignments embedded with mathematics are found in each course syllabus. Academic and CT teachers collaborate to embed mathematics into the CT course. CT teachers are using instructional strategies that improve students' numeracy skills.	A major anchor assignment is found in every course during each grading period. Teachers are following the eight steps for embedding and teaching mathematics. (See Appendix A.) Classroom assessments are administered by CT teachers to validate students' mastery of mathematics standards in the context of career fields.
7. Use of Technology Technology used in instructional programs includes computers, software and technology specific to the broad career area.	Information technology and career-related software are not available to students or not used. Hardware is not available to students or not used.	Information technology and career-related software are used in a limited way. Career-related software and hardware are outdated. Evidence exists of instructors using technology for instruction, but there is little or no evidence of students using it.	The instructional program uses information technology and career-related software, but not in every class, even when it is appropriate. Career-related software and hardware are adequate, but not up to date based on industry standards. Not all students are required to use technology to master career skills. Observational data show evidence of students using spreadsheets, presentation software and career-related software.	The instructional program uses information technology and career-related software in every class when appropriate. Career-related software and hardware are high-tech and up to date based on industry standards. All students are required to use technology to master career skills. Students' informational and technological skills are assessed both in terms of their ability to use the software and their ability to make judgments about information, organize it, synthesize it and paraphrase it in the context of the occupation field.

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1	Level 2	Level 3	Level 4
8. Professional Development CT teachers must be prepared to develop and deliver curriculum and instruction reflecting the needs of the modern workplace and leading to academic and CT success for all students. Professional development helps teachers gain new skills and update old skills in: ■ academic and technical content. ■ classroom management. ■ pedagogy. ■ classroom assessment. ■ project-based learning. ■ embedding academics into CT content.	There is little or no evidence of professional development to strengthen CT teachers' content knowledge and pedagogical skills. Professional development provided has no connection to key practices proven to engage students and improve academic achievement. Professional development provided has no connection to the identified needs of the program.	Professional development is planned with little, if any, input from CT leaders and teachers. CT teachers in this program have received professional development on key practices to engage students: ■ Adapt teaching to different learning styles. ■ Teach through cooperative learning strategies. ■ Use student-centered instruction to motivate and deepen student learning. ■ Help students make connections between the classroom and the real world. There is no evidence that CT teachers in this program collaborate with academic teachers in the school or district. There is no evidence that new CT teachers have completed an initial induction program, work with master teachers or a mentor. CT teachers in this program have had little, if any, opportunity to update their content knowledge and skills. There is evidence that teachers are using these key practices to engage students.	CT leaders and teachers use data to identify gaps and target professional development to eliminate gaps. CT teachers have received professional development on key practices listed in Level 2 and on further practices: ■ Embed literacy skills into technical content. ■ Embed high-level mathematics into technical content. ■ Use project-based learning to deepen understanding. ■ Align classroom assessments to challenging academic and technical standards. There is evidence that CT teachers work with academic teachers to embed literacy and numeracy into the technical content. New CT teachers entering program via an alternative route have completed an initial induction program but do not work with a master teacher or mentor. CT teachers are provided opportunities to update their technical knowledge and skills through workshops, formal classes, externships, etc.	Professional development is focused on both school and CT program needs, and evidence suggests a positive impact on student learning. CT teachers receive continuing professional development with coaching to become proficient in key practices identified in Levels 2 and 3. There is evidence that CT teachers participate in a larger professional learning community. All new CT teachers in the program complete an initial induction program and a formal mentoring program. All CT teachers in the program complete some type of training at least every two years to update their content knowledge and skills. There is evidence that nearly all of the key practices in Levels 2 and 3 are incorporated into unit planning and daily lessons.

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1	Level 2	Level 3	Level 4
9. Guidance and Advisement Guidance and advisement systems provide CT students with opportunities to explore career and educational options, including preparing a plan of study, being connected with a caring adult and attending extra-help sessions. The systems provide opportunities for parental involvement.	There is no evidence of students having opportunities to explore career and educational options. Students do not complete a career-interest inventory. Students do not prepare a plan of study upon entering grade nine.	Students prepare a four-year plan of study with assistance from advisers but with no parental input. The plan of study is focused only on the high school years and does not link to postsecondary education options. Students are not made aware of dual credit opportunities to expand their CT studies.	Students complete a career-interest inventory no later than grade nine. Students set career goals and prepare a six-year plan of study linked to postsecondary education options to achieve those goals. Students are made aware of dual credit opportunities by the 11th or 12th grade. Students are aware of the requirements for various career options and the effort needed to meet those requirements. Students and parents meet with the adviser at least annually to review progress made toward completing the plan and, if needed, adjust the plan to reflect changes in career goals.	An effective teacher-adviser system is in place, and CT teachers serve as teacher-advisers. Students are assigned to an adult mentor who works with them through all four years of high school to help them stay of track. Students are encouraged to enroll in dual credit courses relevant to the CT program. At-risk students are identified upon entering grade nine and provided intervention and support to meet grade-level standards. The school provides information and assistance to parents on topics such as college entrance requirements and financial aid. The high school collaborates with feeder middle grades schools to make students and parents aware of career and educational options.

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1	Level 2	Level 3	Level 4
10. Parental Involvement Parental involvement includes being a part of the decision-making process in helping students choose a CT program of study and supporting students in ways that help them succeed in the program.	Parents have little or no involvement in the CT program and were not involved in their student choosing the program.	Parents are involved in a limited way through student/parent/teacher meetings and annual open houses in the CT lab each year to look at student work.	Parents meet with the student, a CT teacher and a guidance counselor prior to student enrollment in the program to understand the program's expectations. Parents and their students meet at least annually with the CT teacher and guidance counselor to map out a plan, review progress made and revise the plan if needed. A parent satisfaction survey is conducted but not used for program improvement.	Parents are highly involved in the CT program. They participate in planning their student's complete program of study and approve the sequences of academic and CT courses that prepare the student for the transition to postsecondary education. They endorse their student's program of study and goals and monitor progress made toward completing the program and reaching goals. Parents communicate frequently with the school, actively support learning at home, volunteer and collaborate with community groups in support of the program. CT leaders use parent satisfaction survey data to improve the program.

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1	Level 2	Level 3	Level 4
11. Articulation and Dual Enrollment Agreements between Secondary and Postsecondary Institutions Articulation matches course work between secondary and postsecondary education to reduce redundancy, and dual enrollment adds depth to the CT program. The agreement creates local, regional or statewide partnerships between the school district/high school and a technical college, two-year college or four-year college. The agreement establishes policies and procedures for academic and technical content alignment, student eligibility for dual credit courses, criteria for awarding postsecondary credit for dual credit courses, criteria for dual-credit instructors, etc.	No articulation agreement exists for this CT program. No dual enrollment policy is in effect for this CT program.	This CT program is supported by an articulation/agency agreement with the nearby technical or two-year college. Eligibility criteria for enrollment in dual credit CT courses address the required technical skills but not college placement standards for reading, writing and mathematics. No criteria are established for awarding postsecondary credit. There is no evidence that articulation/dual enrollment agreements establish the same requirements for faculty, course syllabi and end-of-course exams, whether taught to high school or college students. There is no evidence that articulation/dual enrollment agreements are reviewed at least every three to four years.	This CT program is supported by articulation/agency agreements with postsecondary institutions within the region. Eligibility criteria for enrollment in dual credit CT courses address the required technical skills and college placement standards in reading, writing and mathematics required for this CT program, but they may differ from the college-placement standards for academic dual credit courses. Criteria are established for awarding postsecondary credit, but credit earned is placed in escrow, rather than being immediately added to the high school and postsecondary transcripts. Articulation/dual enrollment agreements have established the same requirements for faculty teaching dual credit courses, whether to high school or college students. There is no evidence of common course syllabi and end-of-course exams for dual credit courses, whether taught at the high school or college. Articulation/dual enrollment agreements are reviewed at least every two to three years.	This CT program is supported by articulation/agency agreements with multiple postsecondary institutions statewide. Agreements are viewed as essential in creating maximum educational opportunities. Eligibility criteria for enrollment in dual credit CT courses address the required technical skills and set the same college placement standards in reading, writing and mathematics for CT and academic dual credit courses. Criteria are established for awarding postsecondary credit and credit earned is immediately added to the high school and postsecondary transcripts. Articulation/dual enrollment agreements have established the same requirements for faculty, course syllabi and end-of-course exams whether taught to high school or college students. Articulation/dual enrollment agreements are reviewed annually.

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1	Level 2	Level 3	Level 4
12. Advisory Committee An advisory committee represents all stakeholders in the CT program and provides input for the program's continuous improvement.	No advisory committee is established, or the committee exists only on paper.	An advisory committee is established representing a limited number of stakeholders and employers. The committee meets at least once a year, but has minimal influence on issues affecting the program of study. The committee hears reports and gives limited input, but does not make recommendations for future actions.	The advisory committee meets at least twice a year and represents most stakeholders, including business/industry, secondary and postsecondary leaders, teachers, parents and students. Meetings have an established agenda, attendance is taken and minutes are recorded. The committee hears progress reports and makes recommendations.	The advisory committee — balanced with a variety of stakeholders and persons who can influence policy decisions — meets at least quarterly to consider actions requiring input from stakeholders and employers. The committee hears progress reports, makes recommendations and receives feedback on actions taken. The advisory committee takes ownership of the program; works with school and district leadership to ensure program quality; and raises funds to support the program.
13. Marketing, Public Relations and Community Outreach School and CT leaders market the program to students and the school community to ensure all stakeholders are familiar with the program and its curriculum and understand how it links to further study and workforce needs.	There is little evidence of program marketing.	Passive, limited marketing activities reflect the value of the program. The program is described in the school's printed literature and on its Web site. Counselors/teachers have limited knowledge of the program or opportunities for students who complete the program.	The value of the program is reflected in active marketing efforts that reach students, parents and the community. Students and parents participate in career nights and informational events to showcase program and build interest in it. Program information is distributed to students as early as the eighth grade. Teachers/counselors know about the program, its course requirements, the level of academic and technical knowledge needed and career options.	The program is aggressively marketed to all students, parents and community stakeholders. The marketing effort reflects the program's value and alignment to workplace standards and labor market needs. Teachers and counselors are knowledgeable about the program, its course requirements, the level of academic and technical knowledge needed and career options. They encourage students to consider the program. The program encourages local media to cover program events.

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1	Level 2	Level 3	Level 4
14. Enrollment Enrollment in program is a function of students' interests, advisers' direction, and local labor market needs.	Enrollment is less than 60% of program capacity as defined by the school for a three-year period. There is no plan for growing enrollment to program capacity. At least three-fourths of the students enrolled in the program were placed in the program rather than choosing the program due to their career interests.	Enrollment is 60-74% of program capacity as defined by the school for a three-year period. There is a plan for growing enrollment to program capacity. More than half of the students enrolled in the program were placed in the program rather than choosing it due to their career interests.	Enrollment is 75-94% of program capacity as defined by the school for a three-year period. There is a plan for growing enrollment to program capacity. More than half of the students enrolled in the program chose it due to their career interests and planning.	Enrollment is 95-100% of program capacity as defined by the school for a three-year period. There is a plan for how to reach program capacity, and current enrollment has met or exceeded the plan. At least three-fourths of the students enrolled in the program chose it due to their career interests and planning.
15. Retention and Completion Retention measures the staying power of a program in attracting and keeping students. Completion indicates the percentage of students successfully complete all requirements prescribed for the program.	Retention: Less than 60% of students entering this CT program continue past the foundation course for the three-year period. Completion: The percentage of program completers as defined by the school is less than 60% for a three-year period.	Retention: 60-74% of students entering program continue past the foundation course for the three-year period. Completion: The percentage of program completers as defined by school is 60-74% for a three-year period.	75-94% of students entering program continue past the foundation course for the three-year period. The percentage of program completers as defined by the school is 75-94% for a three-year period.	95-100% of students entering program continue past the foundation course for the three-year period. The percentage of program completers as defined by the school is 95-100% for a three-year period.
16. Post Program Positive Placement Program completers who take a job in the program area or who continue postsecondary training in the program area have positive placement.	Less than 50% of graduates from the program are working in the career field or related field, operating entrepreneurial businesses, completing a formal apprenticeship in the career field, enrolled in postsecondary education in the career field, or serving in the military one year after graduation.	50-69% of graduates from the program are working in the career field or related field, operating entrepreneurial businesses, completing a formal apprenticeship in the career field, enrolled in postsecondary education in the career field, or serving in the military one year after graduation.	70-89% of graduates from the program are working in the career field or related field, operating entrepreneurial businesses, completing a formal apprenticeship in the career field, enrolled in postsecondary education in the career field, or serving in the military one year after graduation.	90% of graduates from the program are working in the career field or related field, operating entrepreneurial businesses, completing a formal apprenticeship in the career field, enrolled in postsecondary education in the career field, or serving in the military one year after graduation.

Career/Technical Education — Tool for Evaluating the Quality of a CT Program

Quality Indicators	Level 1	Level 2	Level 3	Level 4
17. State Assessment, *HSTW* Assessment and College-Readiness Assessment Students in the CT program meet benchmarks denoting mastery of standards English/language arts and mathematics.	Less than 25% of students enrolled in the program meet state standards by the end of the three-year period. Less than 25% meet *HSTW/TCTW* college-readiness standards at the end of the three-year period. Less than 25% meet placement standards in English/language arts and mathematics for postsecondary studies.	25-49% of students enrolled in the program meet state standards by the end of the three-year period. 25-49% meet *HSTW/TCTW* college-readiness standards at the end of the three-year period. 25-49% meet placement standards in English/language arts and mathematics for postsecondary studies.	50-74% of students enrolled in the program meet state standards by the end of the three-year period. 50-74% meet *HSTW/TCTW* college-readiness standards at the end of the three-year period. 50-74% meet placement standards in English/language arts and mathematics for postsecondary studies.	75-100% of students enrolled in the program meet state standards by the end of the three-year period. 75-100% meet *HSTW/TCTW* college-readiness standards at the end of the three-year period. 75-100% meet placement standards in English/language arts and mathematics for postsecondary studies.
18. Industry Credentialing and Technical Assessments The CT program leads to industry certification that has value in the workplace. A certification exam can serve as an end-of-program exam and provides students the opportunity to earn an industry credential in addition to their high school diploma.	The program does not pursue available industry credentialing. Less than 25% of students in the program take a certification exam. Pass rates on certification exams are below 60%.	The program offers one industry credential and encourages students to take the certification exam. 25 to 49% of students in program take a certification exam. Pass rates on certification exams are 60-74%.	Students are required to take an industry certification exam. Pass rates on certification exams are 75-89%.	The district and/or high school provides funding for certification exam fees, and all students are required to take the exam. Technical assessment is nationally benchmarked and includes a knowledge-based written component. Passing the technical assessment leads to state licensure or certification. Pass rates on certification exams exceed 90%.

Appendix A: Eight-Step Design Template for Authentic Anchor Project Units

The eight-step process to be used by the interdisciplinary teams is adapted from the framework used in the recently completed study described in *Building Academic Skills in Context: Testing the Value of Enhanced Math Learning in CTE.*[3]

The criteria for developing the prototype design template for **Authentic Anchor Project Units** at a minimum will include the following eight-step process.

1. Identify and describe a major project that is rich with embedded mathematics content that career/technical faculty will have students complete during each 12 weeks of school.
2. Identify the embedded mathematics and technical standard(s) and use of technology tools that can be taught through the authentic integrated project units. This will involve taking the mathematics standards and being deliberate about identifying the specific knowledge and skills students are expected to apply and understand.
3. Identify the literacy study skills and habits of success that students will be expected to apply in advancing their mastery of academic and technical content and skills. This will involve the identification of materials to be read, records to be kept, reports to be written, quality of work expected, behavior expectations for individual and for teamwork, and specifications of other key habits of success important to the 21st-century workplace.
4. Develop a summative assessment that incorporates mathematics and technical content questions and the use of technology questions at the end of the unit. Describe re-teaching strategies for those students who fail to demonstrate mastery and indicate the benchmark level that would be acceptable for demonstrating mastery at the proficient level.
5. Determine how students will be will pre-assessed for current level of knowledge and skills in each of these four domains – mathematics, technical content, the use of technology, and other skills and habits essential to success. Identify the methods and techniques for assessing students' understandings and skills in these areas, including questioning, observations, worksheets, group learning activity, vocabulary, etc.
6. Determine how career/technical faculty will engage students with mathematics and technical content and the use of technology and tools embedded in the authentic anchor project unit. Identify: 1) a series of teacher-directed instructional activities; 2) student assignments aimed at helping students understand the mathematics and technical content; and 3) ways technology will be used to enhance learning. Part of this planning will involve bridging the gap between the language of the pathway field as it relates to the language of mathematics. Help students understand how the language of the workplace and the formal mathematics language are connected without abandoning either. Identify a series of activities that introduce students to these mathematics and technical concepts and to the technology tools and materials involved in completing this project.
7. Decide how mathematics faculty will engage students with mathematics and technical content and the use of technology and tools embedded in the authentic anchor project unit. Develop related contextual mathematics assignments using the embedded mathematics concept in the unit. This will involve having students work through mathematic problems and assignments that are similar to those embedded in the career/technical project. It also will involve using examples with varying levels of difficulty, increasing from basic, to proficient, to advanced. This work will continue to bridge the academic language and the language of the career/technical pathway. Describe how teachers will check for understanding and determine which concepts can be team-taught by the mathematics and career/technical teachers.
8. Describe how students will demonstrate their understanding of mathematics and technical knowledge and skills by completing the project and assignments that provide additional practice.

[2] Stone, James, C. Alfeld, D. Pearson, M.V. Lewis, and S. Jensen. *Building Academic Skills in Context: Testing the Value of Enhanced Math Learning in CTE.* National Research Center for Career and Technical Education, July 2006.


Program Specific

AUTO TECH EVALUATION CHECK LIST

SCHOOL NAME:_____DATE:_____/_____/_____

HIS ☐ **ROP** ☐ **VOC** ☐ **JC** ☐

I**NSTRUCTOR** (S): _____

Other Attendees: _____

A. GENERAL DISCUSSION ISSUES

Problem Area | OK

- ☐ ☐ Has school ordered the NATEF Self-Evaluation Book? Y / N
- ☐ ☐ Discussed Number Areas of Certification school is seeking _____
- ☐ ☐ Discussed Articulation – if applicable
- ☐ ☐ Discussed how Areas of Certification will be determined
- ☐ ☐ Discuss Contact Hours
  _____ Hours X _____ Days X _____ Years = _____
- ☐ ☐ Is the Instructor(s) ASE Certified in areas of instruction?
- ☐ ☐ Discussed importance of Advisory Committee:
  - 5 members minimum - former students, employed techs, employers, consumer reps, etc. - 2 meetings per year
- ☐ ☐ Discussed Standard 5.1 – Pre-Testing / Is there a Pre-test? _____
- ☐ ☐ Discussed Importance of Cirriculum
- ☐ ☐ Checked text books (less than 6 years old)
- ☐ ☐ Electronic Service Information System
- ☐ ☐ Instructor not to handle money

B. SHOP TOUR

1. FIRE SAFETY

- ☐ ☐ Sufficient number of extinguishers (requires a minimum of 3)?
- ☐ ☐ Easily accessible (nothing blocking the path or the flow below)?
- ☐ ☐ Highly noticeable (should be marked with red square behind Extinguisher)?
- ☐ ☐ Are they charged and properly tagged and are the inspections current?
- ☐ ☐ Are the exits properly marked?

2. EYE SAFETY

Problem Area | OK

- ☐ ☐ Do they have eyewash?
- ☐ ☐ Is it easily accessible in an emergency?
- ☐ ☐ Does the eyewash have proper drainage?
- ☐ ☐ Is the eyewash highly visible?
- ☐ ☐ Do all the students have safety glasses?
- ☐ ☐ Are all the students wearing safety glasses?
- ☐ ☐ Are there extra safety glasses for visitors?
- ☐ ☐ Are there face shields and goggles?

3. General Shop and Equipment

- ☐ ☐ Does all equipment have shields and guards?
- ☐ ☐ How do they store chemicals and cleaners?
- ☐ ☐ Fireproof cabinet?
- ☐ ☐ Air hoses in good condition? No hose clamps to hold fittings!
- ☐ ☐ Oxygen/acetylene bottles properly tied down?
- ☐ ☐ Ear protection?
- ☐ ☐ Safety posters?
- ☐ ☐ Floors clean?
- ☐ ☐ Do Yellow and Red lines mark the floor properly?
- ☐ ☐ Aisle and walkways clear and marked?
- ☐ ☐ Solvent tank or tanks in proper working order/with a proper method of fluid disposal?
- ☐ ☐ Water based solvent preferred
- ☐ ☐ Proper storage of oily rags?
- ☐ ☐ Proper disposal of waste oil and oil filters?
- ☐ ☐ Proper disposal of anti-freeze?
- ☐ ☐ Proper disposal system for old tires and batteries?
- ☐ ☐ Is there a tire rack?
- ☐ ☐ Frayed electrical cords or improperly grounded cords? Must have 3-prong male connector.
- ☐ ☐ Drop lights (fluorescent preferred?

4. Miscellaneous Shop Needs

Problem Area	OK	
☐	☐	Classroom independent and separated from shop working area?
☐	☐	Proper ventilation system in place for exhaust exit from shop?
☐	☐	Equipment storage blocking exits, fire extinguishers, aisles, fire alarm, eye wash or emergency electrical cut-off?
☐	☐	MSDS (Material Safey Data Sheets) binder or sheets readily available?
☐	☐	First Aid Kits available?
☐	☐	Are first aid kits properly stocked on a regular basis?
☐	☐	Adequate storage of material and supplies?

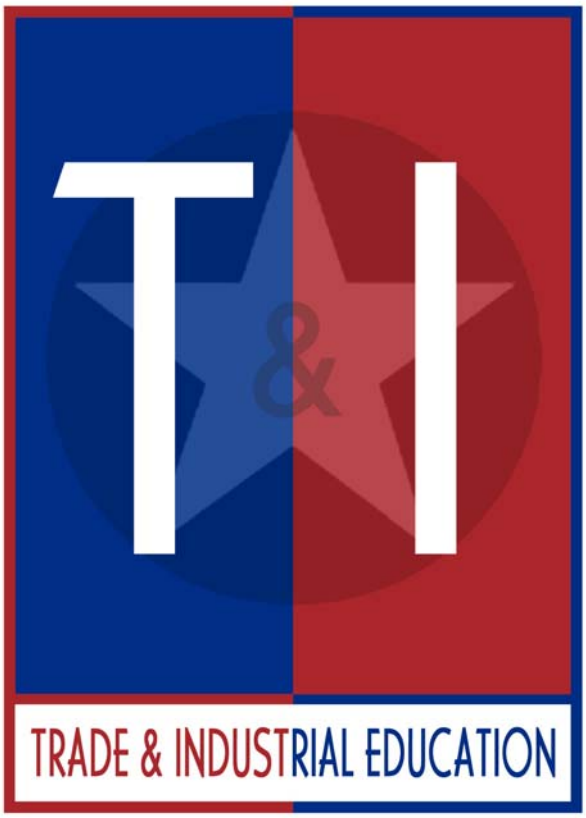
5. **General Shop Conditions**

☐	☐	Overall shop area clean, neat and well lighted?
☐	☐	Are the workbenches clean, neat and free of clutter?
☐	☐	Housekeeping chores attended to daily?
☐	☐	Housekeeping system in place to maintain an overall clean shop appearance?
☐	☐	Scheduled inspections by administration?
☐	☐	Scheduled inspections by local industry?
☐	☐	Scheduled inspections by advisory board?

6. **Collision Repair**

☐	☐	Vacuum-air sanders only?
☐	☐	Hazardous spill response kit?
☐	☐	Fire blanket and case?
☐	☐	Fresh air make-up system?
☐	☐	Waste disposal system that meets local, federal and state regulations?
☐	☐	Are there Respirators and are they of the proper type?
☐	☐	Eye wash basin?
☐	☐	Safety shower?

Trade and Industrial Education Program Evaluation



Introduction:

(TAC), Title 19, Part II Chapter 75, Subchapter BB
75.1025 Program Evaluations.

Each district and consortium shall annually evaluate its career and technology education programs.

The Trade and Industrial Education (TIE) Program Evaluation was developed to assist in evaluating current TIE programs. These criteria may be used to assist schools and TIE programs in identifying program strengths as well as areas for improvement.

The Program Evaluation Criteria were designed for use both by the individual instructor in conducting a comprehensive self-evaluation as well as by an external evaluation team.

The criteria listed do not incorporate all of the state and federal rules and regulations, but those selected should assist personnel in their efforts to off quality TIE programs which lead to higher student achievement.

Program Evaluation Team:

It is recommended that a team consisting of at least the following should conduct the T&I program evaluation process:

- Two or three instructors who are involved in TIE on the campus
- One counselor
- One administrator
- One student who is presently enrolled in TIE
- One person representing students with special needs
- At least two industry partners
- TIE Advisory Committee Chair or representative
- One parent of a present or former TIE student

Trade and Industrial Evaluation Program Evaluation Report

Report Date: _____

Name of School			
Street Address	City	TX State	Zip Code
Name of Principal	Name of Career and Technology Education Director		
Name of School District			District Number
TIE Instructor	Highest Degree Held	Years of Teaching Experience	Years in Related Industry
TIE Instructor	Highest Degree Held	Years of Teaching Experience	Years in Related Industry
TIE Instructor	Highest Degree Held	Years of Teaching Experience	Years in Related Industry
Counselor		Counseling Assignment	
Administrator		Title	
Student		Years in TIE Program	Career Interest
Person Representing Students with Special Needs		Title	
TIE Industry Partner		Title	
TIE Industry Partner		Title	
TIE Advisory Committee Chair or Representative		Title	
Parent Member			

Trade and Industrial Education
Program Evaluation

Levels of Assessment	Interpretation of Level
4-Excellent	Exceeds program standards
3-Good	Meets program standards. No need for additional technical assistance at this time, although some areas, as indicated, could be improved.
2-Needs Improvement	Generally falls below program standards. Demonstrates limited effectiveness. Additional technical assistance and/or resource utilization is a requirement for improvement.
1-Poor or Missing	Little or effectiveness. A great deal of technical assistance is an immediate need.
N/A-does not apply	Does not apply to this program.

Philosophy and Goals	**4**	**3**	**2**	**1**	**N/A**
A statement of philosophy and goals exists in written form (consistent with local, state, and national standards) and is available for administrators, instructors, parents, students, and industry partners to view.					
The program goals are reviewed annually by administrators, instructors, and education and industry partners.					
The philosophy, goals, and objectives of the program reflect the needs of students, parents, and the community.					
Student Enrollment	**4**	**3**	**2**	**1**	**N/A**
The number of special needs students enrolled in the program is in proportion to the number of special needs students enrolled on the campus.					
The program reflects non-traditional gender enrollments.					
Ethnic groups represented in the program reflect the ethnic composition of the school.					
Enrollment and class sizes are manageable and adhere to the recommended TEA guidelines.					
Appropriate procedures are followed with regard to placement of students with disabilities (Vocational Assessment; Placement by Admission, Review, and Dismissal committee).					
Student Documentation	**4**	**3**	**2**	**1**	**N/A**
Individual student folders are developed and maintained on a regular basis, and stored in a secure location.					
Students have a career concentration outlined by a Career Pathway on file.					
Career Pathways are reviewed annually and revised as necessary.					
Appropriate procedures are followed and documented with regard to making modifications for special needs students (Development of Individual Education Plan; Implementation of appropriate modifications to instruction and/or the instructional environment).					
Individual student mastery of safety concepts documented and on file (minimum grade of 90% on safety exam).					

Facilities and Equipment	4	3	2	1	N/A
The facility is well-maintained and in good condition.					
The facility has sufficient space, furniture, equipment, tools, materials and supplies to permit maximum individual student participation in all areas of the T&I program.					
Furniture, equipment, tools, materials and industry-specific technology items are systematically inventoried.					
Furniture, equipment, tools, materials and industry-specific technology are appropriately labeled and readily identified.					
Furniture, equipment, tools, materials and industry-specific technology are upgraded and/or replaced as necessary.					
Short and long-range plans have been developed for replacing/updating furniture, equipment, tools, and industry-specific technology.					
Sufficient and appropriate storage space is provided for equipment, tools, instructional supplies, materials, student supplies and confidential student files.					

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Standard I: Instructional Design:
Designs instruction appropriate for all students (Grades 8-12) that reflects an understanding of relevant content and is based on continuous and appropriate assessment.

		4	3	2	1	N/A
1.1	Lessons reflect an understanding of students' social and developmental characteristics					
1.2	Lessons address students' diverse backgrounds, skills, interests, and abilities					
1.3	A variety of techniques are used to motivate students and to address their learning styles and preferences					
1.4	The curriculum incorporates the Texas Essential Knowledge and Skills (TEKS) for Trade and Industrial Education					
1.5	Instruction makes connections across disciplines					
1.6	Instructional goals and objectives are clear, relevant, and assessed according to industry standards					
1.7	Materials and industry resources enhance student achievement					
1.8	Cognitive- and performance-based assessments are used to evaluate learners					
1.9	Assessment results are used to determine students' strengths and needs and to plan instruction					
1.10	Instructional activities progress sequentially, support stated instructional goals based on the Texas Essential Knowledge and Skills (TEKS), and are validated by a local advisory committee					
1.11	Activities utilize flexible groupings to engage students and to meet instructional goals					
1.12	Lessons and units provide opportunities for students to engage in reflection and closure					
1.13	Instruction applies knowledge in a variety of contextual activities (e.g., interpret technical data, solve industry-related problems)					
1.14	Curriculum incorporates components of all aspects of industry into the T&I classroom					
1.15	Instructional materials and practices are free from bias and discrimination.					
1.16	Instruction incorporates the use of technology where appropriate					

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Standard II: Instructional Management and Safety:
Creates a classroom environment of respect and rapport that fosters a positive climate for learning, equity, and excellence.

		4	3	2	1	N/A
2.1	Strategies are used to ensure that classroom interactions are polite, respectful, and professional					
2.2	Instructional goals, tasks, interactions, assessments, and other elements of the classroom and laboratory environment convey high expectations for student achievement and meet industry standards					
2.3	Classroom rules and procedures, including an effective discipline management plan, promote a safe and effective learning environment					
2.4	Groups are organized and managed to ensure that students work together, and promote students' ability to assume responsible roles and develop collaborative skills and individual accountability applicable to industrial practice					
2.5	Activities and instructional time maximize student learning and safety					
2.6	Routines and procedures are implemented for the safe and effective management of instructional resources					
2.7	Non-instructional duties are coordinated with instructional activities					
2.8	Local, state, and national safety regulations are applied to provide a safe learning environment for students					
2.9	A safety plan for classroom, laboratory, and work-based learning settings complies with local, state, and federal rules and regulations					
2.10	Students maintain ethical work-based standards and monitor their own behavior					
2.11	Physical accessibility is monitored in the classroom and laboratory setting					

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Standard III: Instructional Delivery:
Promotes student learning by providing responsive instruction that makes use of effective communication techniques, instructional strategies that engage students in the learning process, and timely, high-quality feedback.

		4	3	2	1	N/A
3.1	Directions and procedures are communicated clearly, accurately, and with an appropriate level of detail (e.g., procedures, manuals, technical publications)					
3.2	Interpersonal skills (including both verbal and nonverbal skills) actively engage learners					
3.3	Communication techniques enable students to understand content (including questioning and student-led discussions and instructor-led small group discussions					
3.4	Instructional methods, resources, and technologies are suitable for instructional goals and actively engage students in the instructional process					
3.5	Content capitalizes on students' prior knowledge, skills, and experiences					
3.6	Lessons are paced in response to student learning needs					
3.7	Strategies encourage self-motivation, creativity, and active engagement in learning					
3.8	Trade terminology enhances student learning					
3.9	Each student is provided with timely feedback that is accurate, constructive, and specific (e.g., grading rubrics, performance checklists, objective tests, peer critiques, etc.)					
3.10	Instruction is adjusted based on ongoing cognitive- and performance-based assessments of student knowledge and skills					
3.11	Alternative instructional approaches are used to ensure that all students learn and succeed					
3.12	Technology is used effectively to enhance instructional delivery					

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Standard IV: Professional Responsibilities: Exhibits professional roles and responsibilities and adheres to legal and ethical requirements of the profession.						
		4	**3**	**2**	**1**	**N/A**
4.1	Interactions with families and educational partners that have diverse characteristics, backgrounds, needs, skills, and abilities are appropriate					
4.2	Parent/guardian meetings are conducted appropriately					
4.3	Supportive and cooperative relationships with educational partners (internal and external) are maintained					
4.4	Collaborative decision making and problem solving with educational partners supports students' learning					
4.5	Professional responsibilities and duties are performed outside the classroom, laboratory, and work-based learning settings (e.g., serve on committees, volunteer to participate in events and project work with technical advisory committees)					
4.6	Membership is maintained in professional associations and participation occurs in various types of professional development opportunities (e.g., conferences, workshops, work with mentors and other support systems)					
4.7	Occupational specialization and pedagogical knowledge and skills are updated					
4.8	Self-assessment is used to identify strengths, challenges, and potential problems; improve teaching performance; and achieve instructional and professional development goals					
4.9	Knowledge of legal, ethical, and workplace guidelines is used to develop behaviors in education and work-based situations					
4.10	Advisory committee meetings are conducted appropriately					
4.11	Accurate student and professional records are maintained					
4.12	Lifelong learning experiences are used					
4.13	Required occupational certification/licensure is maintained					

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Standard V: Work-Based Learning:
Understands work-based learning approaches and incorporates relevant experiences into the Trade and Industrial curriculum.

		4	3	2	1	N/A
5.1	Teaching strategies unique to work-based models are used					
5.2	Students are assisted in the transition from program completion to employment and/or higher education (e.g., employment opportunities, career preparation requirements, career development resources, career concentrations)					
5.3	Work-based learning activities are matched with student needs and goals					
5.4	Instruction complies with the requirements of work-based training					
5.5	Student progress is evaluated based on work-based standards					
5.6	Follow-up data is used to determine program effectiveness					

Standard VI: Collaborative Relationships:
Understands the role of external and internal partnerships and enters into collaborative relationships with industry, organized labor, parents/guardians, agencies, proprietary and postsecondary institutions, and the community in delivering the Trade and Industrial curriculum.

		4	3	2	1	N/A
6.1	Partnerships are developed among business, education, and community agencies					
6.2	Articulation agreements are developed with education and training partners					
6.3	Advisory committees are organized and meet as required					
6.4	Local civic and service organizations promote T&I education (e.g., market, recruit, provide resources)					
6.5	Educational personnel and community agency representatives are active in providing appropriate services for special needs students					

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		4	3	2	1	N/A
Standard VII: Entrepreneurship: Understands the importance of essential entrepreneurial skills and incorporates these skills into the Trade and Industrial curriculum.						
7.1	Instruction is provided in conducting a market analysis for developing a business plan					
7.2	Labor market information is used to analyze future work force opportunities					
7.3	Marketing and advertising procedures are used					
Standard VIII: Integration of Employability Skills: Understands and integrates employability skills into the Trade and Industrial curriculum.						
8.1	Employability skills are incorporated in the curriculum					
Standard IX: Leadership: Understands and fosters the development of appropriate leadership skills through the delivery of the Trade and Industrial curriculum and the implementation of the T&I student organization.						
9.1	Leadership skills are incorporated where appropriate					
9.2	Conflict-resolution skills are taught and applied					
9.3	Problem-solving techniques are taught and applied					
9.4	Students are provided with community service opportunities					
9.5	T&I program is marketed effectively					
9.6	A Trade & Industrial Career & Technology Student Organization (CTSO) chapter is established and is active					

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Standard X: Technology:
Understands and integrates relevant technology in delivering the Trade and Industrial curriculum.

		4	3	2	1	N/A
10.1	Technology applications promote and assess student learning					
10.2	Technology plans and associated budgets are used					
10.3	Technology is incorporated to improve students' knowledge and skill development					
10.4	Productivity tools are used for instructional and administrative tasks					
10.5	Technology is used for computer-mediated equipment and software for individualized instruction					
10.6	Technology is used for career guidance (e.g., assess for interest, aptitude, and abilities; career decision making)					
10.7	Technology is incorporated to reinforce academic skills					

Additional Strengths:

Additional Areas for Improvement: